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Edited by

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U. S. NAVY



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TRUMAN H. NEWBERRY,
Acting Secretary.

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PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April, 1907, as a means of supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to the naval medical officer, reports from various sources, historical essays, notes and comments on topics of medical interest, and reviews, or notices of the latest published medical books.

The bureau extends an invitation to all medical officers to prepare and forward, with a view to publication, contributions on subjects of interest to naval medical officers.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of commendation to authors of papers of outstanding merit and will recommend that copies of such letters be made a part of the official records of the officers concerned.

The bureau does not necessarily undertake to indorse all views or opinions which may be expressed in the pages of this publication.

E. R. STITT,
Surgeon General United States Navy.

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Contributions to the BULLETIN should be typewritten, *double spaced*, on plain paper, and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication. For example, addresses, dates, etc., not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in headings and captions, and the editor can be spared much time and trouble, and unnecessary changes in manuscript can be obviated if authors will follow in these particulars the practice of recent issues.

The greatest accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible for the editor to understand or verify references, quotations, etc. The frequency of gross errors in orthography in many contributions is conclusive evidence that authors often fail to read over their manuscripts after they have been typewritten.

Contributions must be received two months prior to the date of the issue for which they are intended.

The editor is not responsible for the safe return of manuscript and pictures. All materials supplied for illustrations, if not original, should be accompanied by a reference to the source and a statement as to whether or not reproduction has been authorized.

The BULLETIN intends to print *only original articles, translations, in whole or in part, reviews, and reports and notices of Government or departmental activities, official announcements, etc.* All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere without an understanding to that effect.

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U. S. NAVAL MEDICAL BULLETIN

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SPECIAL ARTICLES

MAINTENANCE OF EQUILIBRIUM IN AVIATION

By C. M. LONGSTRETH, Lieutenant (Junior Grade), Medical Corps, United States Navy

The maintenance or restoration of a normal state of balance in the human body is a complex mechanism depending upon the proper coordination of several of the special senses. It is impossible to state that equilibrium is dependent upon any certain one of the senses, as it seems to depend upon a proper correlation of the stimuli received from the various senses.

In aviation medicine, where we are dealing with the human body in an entirely new environment, the various senses may assume a different rôle in order of importance. However, because of the newness of the subject and the small amount of material to be found in the literature, it is my purpose in this paper to give a rather general idea of the whole subject and not to go into great detail.

In order of importance it seems that the following special senses keep the individual informed of his space relations—namely, (1) vision, (2) muscle sense, (3) tactile sense, (4) kinetic-static sense, and (5) possibly hydrostatic changes in the body tissues.

1. Vision, as a sense used in the maintenance of equilibrium, seems to be by far the most important to the aviator. From the time that the flyer leaves the beach until he returns there is a continual demand upon his eyesight for the safe control of his ship.

When the student first starts to fly he finds considerable difficulty in keeping the nose of the plane from climbing too high and in keeping the wings level. But as his training progresses he learns to correct these conditions by keeping in view a certain relationship between the nose of the plane and the horizon. The importance of a definite horizon may be greatly impressed upon the student if he tries to fly when there is considerable fog and a hazy horizon. Even an experienced flyer will encounter much difficulty and embarrassment in keeping on an even keel if the plane enters a cloud and remains cut off from sight of the earth and horizon. The plane

may even go into a spin before the pilot becomes aware that he is failing to keep a level course. In case the flyer can not keep in touch with the earth by direct vision, it becomes necessary to do so by the use of instruments. Thus we see that the flyer must at all times keep himself informed of his position in relation to the earth, either by direct vision or by the aid of his instruments.

2. The muscle sense refers to the sensations received from the muscles, joints, and ligaments. It is through this sense that the individual becomes conscious of pressure, weight, and change of position in the muscles, tendons, and joints.

This is the system for deep sensibility, and the fibers which conduct these impulses run chiefly with the nerves to the muscles. The pathways for muscle sense and tactile discrimination after entering the cord pass along the posterior columns of the cord to the *nucleus gracilis* and *nucleus cuneatus* of the medulla, then by the mesial fillet to the optic thalamus, and finally to the cerebrum. For the maintenance of equilibrium the chief paths are the dorsal and ventral cerebellar tracts. The dorsal cerebellar tract arises from the cells forming Clark's column, which are situated on the inner side of the gray matter of the posterior horn. After passing up the cord the fibers pass to the cerebellum through the inferior cerebellar peduncle and terminate in the vermis.

The ventral cerebellar tract arises from cells in the gray matter and passes upward in the cord to go to the cerebellum through the superior cerebellar peduncle and terminate in the vermis.

Thus, we see that along these paths definite information is brought to the consciousness of the individual of the position of the different parts of the body. Likewise, to the experienced flyer who has learned the so-called "feel of the ship" or "air sense," there is information obtained in this way in regard to the control of the plane. Through training the pilot is able to tell probably by the feel of "rolling about in the seat," when the plane skids or slips in a turn. In climbing there is felt the pressure of the seat and in a too sudden dive the pilot may feel himself thrown forward against the safety belt. These and the many other sensations brought to the consciousness of the pilot through his muscle sense inform him to a great extent of the position of the ship, and will even warn him when the plane has lost flying speed as indicated by the inefficiency of the controls.

It is very possible that the pilot in a tail spin receives more information from the muscle sense than from any of the other senses, excepting vision. For he will probably feel himself "drop off" on one wing and by the pressure on one side of his body know that he is going into a spin to the right or to the left.

There seems no doubt to me that the muscle sense gives more information to the pilot in either straight flight or stunt work than

any of the other senses, excepting vision. But, to use this sense, the pilot must be trained and experienced properly to interpret these sensations and learn almost instinctively to react with the proper muscular responses to control the ship when a certain group of sensations is received.

3. The tactile sense, or the ability to recognize a light touch over hairless parts of the body or cutaneous localization, is a much more delicate sense and probably offers very little aid to the maintenance of equilibrium in flying. It is possible that when a strong blast of wind strikes the face, as may be encountered in a spin or in a severe skid, some information may be gained thereby. But it seems that the tactile sense in itself offers very meager help. As Bauer has suggested, when the pilot is clothed in a heavy fur-lined flying suit with helmet, goggles, and gloves, and even inclosed within a cabin, there is little opportunity for him to gain any very definite information from the tactile sense.

4. The kinetic-static portion of the ear, consisting of the saccule, utricle, and the three semicircular canals, has been given considerable importance in the maintenance of equilibrium. During the late war the kinetic-static labyrinth was considered the most important factor in flying and as a result a very thorough examination of the ear was considered essential.

It is a well-known fact that the condition of the labyrinth can be very well determined by stimulating the semicircular canals. This may be done by turning, by douching the ears with cold or hot water, or by application of the galvanic current to the ear. The presence or absence of nystagmus, whether or not it is delayed in onset, the presence of past-pointing, falling, and vertigo following stimulation of the semicircular canals, will indicate the condition of the labyrinth and the continuity of the nerve paths from the ear to the cerebellum and cerebrum.

The pathways of the nerve tracts from the vestibular portion of the ear have not, as yet, been definitely proved. However, it was shown histologically by Ramon y Cajal that fibers from the vestibular portion of the eighth nerve enter Deiters's nucleus to pass through the inferior cerebellar peduncle into the cerebellum. According to Isaac H. Jones, as stated in his book *Equilibrium and Vertigo*, it seems that after the fibers enter the brain stem there is a separate and distinct pathway for each of the horizontal and vertical semicircular canals.

The vestibular tracts arise from the end-organs within the labyrinth—from the maculae of the utricle and saccule and the cristae of the three semicircular canals. The fibers from the horizontal canal are relayed in Scarpa's ganglion and enter the bundle of the eighth nerve, in which they pass to the medulla oblongata. In the

medulla the fibers pass to the posterior external portion to enter Deiters's nucleus, where the tract is divided into two separate pathways. One path goes through the nucleus triangularis toward the median line to enter the posterior longitudinal bundle which is located in the midline along the posterior portion of the medulla and pons. From the posterior longitudinal bundle the fibers are connected with the third and sixth ocular nuclei. This is the pathway over which the impulse must travel to cause vestibular nystagmus. The second pathway of the horizontal fibers, after the separation has taken place in Deiters's nucleus, goes through the medial portion of the inferior cerebellar peduncle to the three vestibular nuclei in the cerebellum—namely, the *nuclei globosus*, *emboliformis*, and *fastigii*.

Likewise, the fibers from the superior and posterior semicircular canals enter the eighth nerve to pass to the medulla oblongata where, instead of going to Deiters's nucleus, they continue upward along the brain stem in a course external to the posterior longitudinal bundle. In the upper half of the pons it is thought that the tract divides into two portions; one portion of the division going to the posterior longitudinal bundle and thus being brought into relation with the third and sixth ocular nuclei to complete the vestibulo-ocular tract of the vertical canals. This tract carries the impulse for nystagmus. The other portion of the division passes directly through the middle cerebellar peduncle to go to the cerebellum where the tract comes in contact with the three vestibular cerebellar nuclei—*globosus*, *emboliformis* and *fastigii*. Thus the impulse is conveyed to the cerebellum and the further continuation of the tract from the cerebellum to the cerebral cortex conveys the impulse for vertigo.

A normal response from the routine tests of the vestibular portion of the ear will indicate a normal labyrinth and a normal transmission of the impulse through the brain-stem to the cerebellum and the cerebral cortex. That these structures should be normal and free from pathological conditions can not be denied. But in apparently normal individuals there is a wide range in the degree of response from the vestibular apparatus. For example, in the qualifications of a naval aviator an after-turning nystagmus of "26 seconds' duration with a variation of 10 seconds above or 12 seconds below is allowable." At present it is unknown whether the candidate for aviation training with 14 seconds' duration of nystagmus as compared with the one of 36 seconds may be better or worse or no different.

It has been found in some of the experienced flyers that their nystagmus time may be markedly decreased in duration and in some cases they may even avoid falling after turning and show no symptoms of vertigo. It would appear that this response is possibly a

matter of training. They have probably learned to disregard largely the sensations from the vestibular apparatus and to interpret the stimulus to indicate just the opposite condition.

While turning to the right in a Barany chair with eyes closed an individual at first realizes that he is being turned to the right. But if the chair is brought to a stop he gets the sensation of being turned to the left. If the flyer were to depend upon his vestibular apparatus when coming out of a tail spin it is very possible that when the plane was controlled from spinning to the right the pilot would get a sensation of spinning to the left even though the maneuver had already been controlled. Then too, it is very doubtful if a man subject to vertigo from turning, and who did not learn to control the condition, could ever be a combat pilot.

The information obtained from the labyrinth must be interpreted to mean just the opposite to the sensation so produced, in many instances, and the flyer must guard against the vertigo so imposed upon him. In straight flight where there is no gross change in movements and position, there seems to be no stimulation whatever of the labyrinth. If an experienced flyer, who is untrained in blind flying with the aid of instruments, finds himself suddenly within a cloud where visual contact with the earth is cut off, great difficulty is encountered in keeping on a level course. If he is compelled to fly more than a few minutes within the cloud, he loses all idea of the position of his ship and not at all uncommonly goes into a spin, out of control. The vestibular mechanism has thus failed to furnish the information necessary for the pilot to maintain his equilibrium.

It therefore seems that the kinetic-static sense is affected only by very gross stimulations and the information so obtained is very often misleading and may even be detrimental. It may even be possible that the flyer could more easily and comfortably control his plane if he were born without a vestibular mechanism.

5. The value of the special sense, consisting of the effects of hydrostatic changes upon the body tissues, in the maintenance of equilibrium is quite theoretical at present. It has already been proved, however, that in some of the lower animals a gravity condition may even cause death by an interference with the circulation.

That there is a definite influence of gravity upon the circulation of an animal has been proved in the experiments of Leonard Hill (1895).

It was shown that if a snake was pinned out on a flat surface and an opening made opposite the heart the organ continued to function normally so long as the position was maintained in the horizontal. But when the snake was placed in the vertical position the heart soon became bloodless and death resulted. However, if the the tail

end of the reptile is placed in a cylinder of water so as to overcome the effect of gravity, the heart will again be seen to fill with blood.

Then, too, if a domestic rabbit with a large pendulous abdomen be held in the vertical position for 15 to 20 minutes, it will die as a result of cerebral anemia. By first applying an abdominal binder to the animal and then holding it in the vertical position the results are very much altered. Thus, it is shown what the evil effects of gravity upon the circulation may be where there is no mechanism to compensate for the condition.

It was also shown, experimentally, what the effect upon the arterial blood pressure in a dog might be when associated with a disturbance of the compensating mechanism. The dog was placed under light ether anesthesia and held in the vertical, tail-down position, and the tracing showed an immediate fall in the arterial blood pressure. If the degree of anesthesia is markedly increased, the tracing will show a marked initial fall in the blood pressure and practically an absence of any subsequent compensation.

Garsaux, in experimenting on dogs, rotated the animals on a wheel at the speed of four to six turns per second. Some of the dogs showed actual injury to the brain from the pressure against the skull—recovery was seen in some and death occurred in others. The autopsy findings showed an anemia of the brain and engorgement of the vessels in the abdominal area.

The compensating mechanism was shown by Leonard Hill to be made up of three factors—(1) the tonicity of the abdominal musculature; (2) the tone of the splanchnic blood vessels; (3) the pumping action of the respiratory movements. The importance of the first factor can be shown by making a crucial incision in the abdominal walls of an animal in the erect position, and of the second factor by cutting the great splanchnic nerves of the spinal cord. Such a procedure will cause a definite fall in the arterial blood pressure even while the animal is in the horizontal position. Then, if the animal is placed in the vertical, tail-down position, the blood pressure falls to the zero line and the animal soon dies. The third factor seems to be of less significance than the first two, but it can be shown by the increased respiratory activity which is likely to develop in the vertical, tail-down position, the anemic condition of the respiratory center being probably the cause of the increased respiration.

The tone of the blood vessels has been shown by Bayliss to be a state of contraction of a moderate degree, and this condition can be made greater by certain nerves and to relax by other nerves.

It was shown by Gaskell (1885) that the origin of the vaso-constrictor nerves from the central nervous system is in the white rami forming the sympathetic system. This area extends from the first or second thoracic to the four or fifth lumbar segments, inclusive.

The anatomical arrangement of the vaso-dilator nerves is more irregular in nature than is that of the vaso-constrictors. Thus, no general statement can be made. Certain of the nerves in the bulbar region of the brain contain fibers which cause, in some way, a dilatation of the arterioles supplied by them; e. g., the *chorda tympani*, arising from the intermediate nerve of Wrisberg, which may be described as a typical vaso-dilator. Then we have similar nerves arising from the sacral cord in the pelvic system of nerves; e. g., the *nervi erigentes*, causing relaxation of the arteries in the corpora cavernosa and spongiosa.

It has also been shown that reflexes to vasomotor nerves are readily evoked by stimulation of various afferent nerves, and that they may be either of the nature of vaso-dilatation or vaso-constriction and have been referred to as the afferent nerves from blood vessels. The vaso-dilators have been called the "depressor" reflexes and the vaso-constrictors the "pressor" reflexes. Then there must be, accordingly, some region or regions in the central nervous system serving as centers for these reflexes. Work along these lines was done by Dittmar (1873) and by Ransom and Billingsley (1916). It has been shown that these centers are located in the bulb and apparently are the supreme coordinating centers. When vasomotor effects are obtained from higher parts of the brain, it seems that the stimulation of afferent fibers to the bulbar centers is responsible.

Then, as in the case of reflexes generally, there are subordinate relay centers in the spinal cord, and there are also cell stations in the ganglia of the sympathetic chains and more peripherally situated plexuses in the case of the vaso-constrictor nerves.

This control of the state of contraction of the arterioles by the central nervous system (according to Bayliss) may be said to serve two main purposes. A generalized vaso-constriction raises the aortic pressure and affords a better blood supply to organs whose arterioles are not narrowed, because they are either poorly, or not at all, supplied with vaso-constrictor nerves, such as the coronary vessels of the heart and the vessels of the brain. It may be said that the heart and brain are of such supreme importance and so sensitive to deficient supply of blood that the rest of the body has to be subservient to them. The chief use of a generalized dilatation seems to be to relieve the heart from the effort required to pump the blood against too high an arterial pressure.

According to the views of Leonard Hill the vasomotor centers are sensitive directly to changes in the pressure of the blood supplying them; a fall of pressure causing vaso-constriction, a rise causing vaso-dilatation. This view that the centers respond to changes in the blood pressure in the vessels supplying them is supported by the observation of Hedon (1910). In his work the cerebral end of

one carotid in a dog (A) was connected to the heart end of that of another dog (B), so that a rise or fall in the arterial pressure of B would be immediately felt by the nerve centers of A. If any effect on the arterial pressure of A were the result of blood flowing from one to the other, it would be in the same direction in both. It was found that a rise in B caused a fall in A and a fall in B caused a rise in A. So it thus appeared that vaso-constriction was produced by a fall in the pressure in the cerebral arteries and dilatation by a rise. It was thought that these changes to which the centers are sensitive may be either the pressure itself or of a chemical nature, as by variations in oxygen supply.

However, the above experiments would seem to show that the body is in very intimate contact with any variations in blood pressure or any irregularity in the distribution of the blood supply throughout the vascular system. The body is apparently making continued adjustments through the vasomotor system to these changes which may be brought about by changes in posture, speed, stimulation, or drugs (experimentally). As has been suggested by Schneider in his study of the effects of speed it would seem that the blood supply of the brain was temporarily deficient due to the excessive centrifugal force. The winner of the Pulitzer trophy in 1922 stated that he was unconscious when making turns. Then again in the Pulitzer race in 1923, won at a speed of 243.7 miles per hour, the winner was probably in a daze suffering from a temporary cerebral anemia as suggested by the fact that he went around the course an additional time.

When making a sharp turn in a plane to the left the ship is banked in such a way that the wings and pilot's body are almost at right angles to their former position. Thus the force in the original direction would be in the direction away from the pilot's head or toward his feet. The pilot being strapped in the machine can not be displaced, but the centrifugal force will tend to move everything that is movable in the original direction. So it is that the blood will tend to leave the head and be displaced toward the lower extremities and into the dilated splanchnic vessels, giving the temporary cerebral anemia with the resulting symptoms of dizziness, haziness, or even unconsciousness. It is a known fact, of course, that the veins of the abdomen may contain about a third of the entire amount of blood in the body.

In view of all these facts, may it not be possible that the pilot does made adjustments in his control of the plane not only to such a marked stimulation as we have seen in making the sharp turns at a high speed but also as he flies in the ordinary manner? That there is a variation in the distribution of the blood in the pilot's body is evident, which condition, through the vasomotor system, will be

able to excite the vasomotor centers in the bulb which, in turn, may convey the impulse to the higher parts of the brain. In this way we may expect that the pilot gains some information as to the position of his body and also makes the corresponding adjustments as indicated by such excitations.

Then, if hydrostatic changes are in evidence in the vascular system of the body it is very possible that gravity changes will also effect the body viscera and the ventricles of the brain, the stimulation of the viscera and brain ventricles by hydrostatic changes being brought about by communication with the central nervous system through the sympathetics.

In this way the body may make voluntary or involuntary corrections in its position and space relations to maintain a normal balance in the hydrostatic pressure.

It has already been found that when a combat pilot comes out of a steep dive, flying at great speed, there is a temporary blurring and dimming of vision. This condition may be greatly relieved if the pilot will give a loud cry just as he comes out of the dive. In so doing he tends to prevent the pooling of blood in the splanchnic area which causes the temporary cerebral anemia. This experience is especially convincing in regard to the hydrostatic changes upon the vascular system.

To summarize it would seem that equilibrium is maintained in the flyer by vision, muscle sense, and possibly by the hydrostatic changes in the body tissues. The tactile sense may possibly give some information at times, but it is not to be depended upon, while the kinetic-static sense can probably be considered as giving misleading information and may even be detrimental at times.

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PHYSICAL QUALIFICATIONS AND AERONAUTICAL ADAPTABILITY

By ALBERT ICKSTADT, Jr., Lieutenant (Junior Grade), Medical Corps, United States Navy

Certain physical standards have been established for the selection of aviation candidates in the Navy, and they are more rigid than those set forth by the Department of Commerce for certain types of pilots whom they will license. Why then, are our standards more severe? It is of little moment to the Department of Commerce what the probable duration of a pilot's qualifications will be, for they

are licensed from year to year. In the Navy, however, in passing a candidate for aviation training, not only his present physical findings must be considered, but also the probable length of time they will remain within qualifying limits for, because of the exhaustiveness of the course and the cost thereof, it is not sufficient for the graduate to remain fit for one or two years. He must maintain his efficiency for 10 or 12 years to make the investment a paying proposition to the Government. Hence it is evident that our present standards were devised, not particularly for the purpose of deciding who should be able to learn to fly, but rather with an eye to the probable length of a pilot's usefulness in military flying.

The question of whether or not these physical standards are too severe must be left for further study and investigation; but an effort to determine whether or not varying degrees of physical imperfections within allowed limits bear any relationship to ability to learn to fly is here attempted, and several questions which can only be solved by statistical correlation are presented.

Do students with allowable defects fail to qualify in greater proportion than do those without such defects? Do students with allowable hyperphoria fail to qualify in greater percentage than those without it? Are anisometropia, a high depth perception, absence of complete ocular poise, long or short labyrinthian response or variation between the response of each labyrinth, or any other physical findings causes for failure to qualify?

In an attempt to answer these questions a series of candidates comprising members of seven consecutive classes were chosen. An effort was made to record the findings of the special examinations given each student upon reporting at the naval air station, Pensacola, because, in some instances at least, the original examination had been performed 12 months or more prior to his arrival, and it was felt that this special examination would mirror more accurately, perhaps, the actual condition in which each student commenced training. In some cases, however, these results were not obtainable, and then the records were taken either from the original or from the annual *Naval Medical School Aviation Form No. 1*. This analysis was undertaken with the idea of determining a possible relation between physical findings and final marks given students in their work in primary seaplanes, no attention being paid to their subsequent fate, since the greatest attrition occurs during primary training.

The original number being decided upon was 500 but the available records brought the number down to 486. Also, it will doubtless be noted that the total in some instances does not agree with the stated number of cases. While it is evident that analysis of the various phorias would give a smaller total than the whole, the discrepancy

between total cases of depth perception, labyrinthian reaction, etc., must be explained—it is due to the fact that these findings were occasionally omitted from the available Form No. 1.

Of 486 students in seven successive aviation classes, 247, or 50.9 per cent failed, while 239, or 49.1 per cent, passed. It is evident then, that of an unselected group starting training in primary sea-planes a shade more than half fail, for one reason or another, to pass their final check. Why? Is it because of hyperphoria, ocular imbalance, variations in labyrinthian response, etc.? In other words, are our physical requirements too lax? If such be the case, it is logical to assume that those students just within the allowable limits should show a far higher percentage of failures than do those who most nearly approach the ideal. Let us see.

DEPTH PERCEPTION

That no correlation exists between variation of depth perception and failures is evident from the following: Of 81 students with a depth perception of 5 millimeters or less, 40 failed and 41 passed; of 176 students with a depth perception of between 5 and 10, 91 failed and 85 passed; of 123 with a depth perception of between 10 and 15, 50 failed and 73 passed; of 71 with a depth perception of between 15 and 20, 47 failed and 23 passed; of 34 with a depth perception of 20 to 25, 19 failed and 16 passed. This is shown in percentage in the accompanying table. (Table 1.)

TABLE No. 1

	0-5	5-10	10-15	15-20	20-25	Total
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
Failed.....	49.2	54.6	40.5	65.8	55.1	50.6
Passed.....	50.8	45.4	59.5	34.2	44.9	49.4

Of 380 students with a depth perception of 15 or less, 199, or 51.7 per cent, failed; while of 106 students with a depth perception of more than 15, 66, or 62 per cent, failed.

LATERAL OCULAR POISE

The state of lateral ocular balance has no significant effect on a student's ability, as is brought out in the following: Of 274 students showing an esophoria at 6 meters, 139 failed; while of 212 without such esophoria, 107 failed; of 127 students showing an exophoria at 6 meters, 56 failed, while of 359 without such exophoria, 191 failed; of 70 students showing an esophoria at 33 centimeters, 37 failed, while of 416 students without such esophoria, 210 failed; of

402 students showing an exophoria at 33 centimeters, 201 failed, while of 84 students without such exophoria, 46 failed. (Table 2.)

TABLE No. 2

	Esophoria				Exophoria			
	At 6 meters		At 33 centimeters		At 6 meters		At 33 centimeters	
	Present	Absent	Present	Absent	Present	Absent	Present	Absent
Failed.....	<i>Per cent</i> 52.8	<i>Per cent</i> 50.3	<i>Per cent</i> 51.8	<i>Per cent</i> 50.4	<i>Per cent</i> 44.8	<i>Per cent</i> 53.5	<i>Per cent</i> 50	<i>Per cent</i> 55
Passed.....	47.2	49.7	48.2	49.6	55.2	46.5	50	45

HYPERPHORIA

Nor did the degree of hyperphoria have any influence, for, of 88 students showing a hyperphoria of 0.25, 45 failed and 43 passed; of 101 showing hyperphoria between 0.25 and 0.50, 44 failed and 57 passed; of 23 with hyperphoria between 0.50 and 0.75, 12 failed and 11 passed. Of these 212 students with hyperphoria, 101 failed, while of 274 students showing no hyperphoria, 146 failed. (Table 3.)

TABLE No. 3

	Hyperphoria			
	No hyperphoria	0.25 di- opter	0.50 di- opter	0.75 di- opter
Failed.....	<i>Per cent</i> 52.5	<i>Per cent</i> 50.8	<i>Per cent</i> 43.6	<i>Per cent</i> 52.3
Passed.....	47.5	49.2	56.4	47.7

ACCOMMODATION

Variation in accommodative powers of the two eyes within allowed limits is here shown to bear no significant relation to the student's ability to learn to fly for, of 209 students showing the same accommodative power in each eye, 95 failed and 114 passed; of 203 students with a variation of 0.50 diopters between each eye, 100 failed; of 56 showing a variation of 1.0 diopter, 42 failed; of 12 showing a variation of 1.5 diopters, 7 failed; of 4 showing a variation of 2.0 or more diopters, 2 passed. (Table 4.)

TABLE No. 4

	Accommodation				
	Some	Difference of 0.5	Difference of 1.0	Difference of 1.5	Difference of 2.0 or more
Failed.....	<i>Per cent</i> 45.4	<i>Per cent</i> 49	<i>Per cent</i> 75.6	<i>Per cent</i> 53.1	<i>Per cent</i> 50
Passed.....	54.6	51.1	24.4	41.9	50

It is noted that 75.6 per cent with a variation of one diopter failed, but this finding is offset by the fact that the percentages of passes and failures in the higher variations are more nearly equal.

Of 468 students showing a variation of one diopter or less, 237, or 50.8 per cent, failed, while of 16 with a variation of more than one diopter between the two eyes, only 9, or 55.8 per cent, failed.

ANISOMETROPIA

The presence or absence of anisometropia is here shown to bear little relation to a student's fate. Of 385 cases in which the true correction was recorded, 226, or 58.8 per cent, had the same true correction in each eye. Of these 226 students with isometropia, 125 failed. Of 159 recorded cases of anisometropia, 80 failed. (Table 5.)

TABLE No. 5

	True correction		
	Isometropia	Anisometropia	Total
Failed.....	<i>Per cent</i> 55	<i>Per cent</i> 50.4	<i>Per cent</i> 53.3
Passed.....	45	49.6	46.7

LABYRINTHIAN REACTION

Does the duration of nystagmus following rotation in the Barany chair bear any relation to a student's fate? In an effort to arrive at some conclusion the time was divided into three periods: The first period included those whose response fell within the limits of 14 to 22 seconds and of whom one might say a tendency toward hypo-irritability existed; the second period of 23 to 29 seconds would then include those students most nearly approaching the average normal of 26 seconds; the third period, from 30 to 36 seconds, would include those cases in whom a slight tendency toward hyperirritability might exist. For this table all students showing a variation of three seconds

or less between the response of each labyrinth were chosen. Those cases showing a variation of one were called the lower figure, an average was taken in those showing a variation of two, while in those with a variation of three, two seconds were added to the smaller figure. It was found, as is shown in Table 6, that the percentage of failures is so constant in each of the three groups as to show that, within allowed limits, the actual time of nystagmus is no indication of the student's flying ability.

TABLE NO. 6

	Nystagmus			
	14-22 sec.	23-29 sec.	30-36 sec.	Total
Failed.....	<i>Per cent</i> 56	<i>Per cent</i> 45.5	<i>Per cent</i> 53.6	<i>Per cent</i> 51.1
Passed.....	44	54.5	46.4	48.9

Regardless of the actual duration of nystagmus, does a difference of nystagmus time between the two labyrinths have any significant relationship to a student's success or failure? That it does not is evident from the following: Of 459 cases in which the labyrinthian reactions were recorded, 237 failed; of 98 cases with no difference, 55 failed; of 104 cases with a difference of 1 second, 58 failed; of 141 cases with 2 seconds' difference, 64 failed; of 47 cases with 3 seconds' difference, 22 failed; of 43 cases with 4 seconds' difference, 23 failed; of 15 cases with 5 seconds' difference, 8 failed; of 11 cases with more than 5 seconds' difference, 7 failed. (Table 7.)

TABLE NO. 7

	Number of seconds difference between two labyrinths							
	No difference	Difference of 1	Of 2	Of 3	Of 4	Of 5	Of more	Total
Failed.....	<i>Per cent</i> 56.1	<i>Per cent</i> 50.5	<i>Per cent</i> 45.4	<i>Per cent</i> 46.9	<i>Per cent</i> 53.6	<i>Per cent</i> 52.8	<i>Per cent</i> 63.6	<i>Per cent</i> 51.7
Passed.....	43.9	49.5	54.6	53.1	46.4	47.2	36.4	48.3

Of these 459 cases, 390, or 85 per cent, had a difference of 3 seconds or less, and of these, 199, or 51.5 per cent, failed; while of the 69 cases with a difference of more than 3 seconds, 38, or 54.7 per cent failed.

Thus far both successes and failures have jointly been considered. What about the outstanding men, our best students? Perhaps before considering them it might be well to discuss briefly our system of grading for the benefit of those not familiar with the military

system. In civil life it is the practice to grade on a basis of 100, but in the Navy men are graded on a basis of 4.0, which corresponds to the civilian 100. A grade of 2.95 was considered to be a fair dividing line between our best and our average students. While this equals only 62.5 per cent on a basis of 100, yet not one of these 486 cases received a grade of 3.5, which would correspond to 87.5 per cent. Therefore it is evident that the two systems can not be compared in this fashion and that a grade of 2.95 means more than does the 62.5 per cent of civil life.

Of 69 students whose records were complete and who had a grade of 2.95 or more, the following was observed:

1. 54, or 78.3 per cent, had a depth perception of 15 or less.
2. 49, or 71.0 per cent, had no hyperphoria.
3. 64, or 92.8 per cent, had a difference of one diopter or less in the accommodative powers of their eyes.
4. 40, or 58 per cent, were isotropic.
5. 63, or 91.4 per cent, showed a difference of 3 seconds or less in labyrinthian response.

Excluding 4, our percentages are most gratifying and conclusive. Are these physical findings the deciding qualities of a successful candidate? Let us see what a similar survey of the failures will bring forth.

Of 202 students whose records were complete and who failed we find that:

1. 150, or 73.5 per cent, had a depth perception of 15 or less.
2. 119, or 58.3 per cent, had no hyperphoria.
3. 192, or 94 per cent, had a difference of one diopter or less in the accommodative power of their eyes.
4. 121, or 59.3 per cent, were isotropic.
5. 171, or 83.8 per cent, had a variation of three seconds or less in labyrinthian response. (Table 8.)

TABLE No. 8.—*Comparison of best and of failures*

	Depth percep- tion 15 mm. or less	Absence of hyper- phoria	Accom- modative difference of 1 diopter	Presence of isotro- pia	Differ- ence of 3 seconds in laby- rinths
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
Best men.....	78.3	71.0	92.8	58.0	91.4
Failures.....	73.5	58.3	94.0	59.3	83.8

Excepting the relative percentages of hyperphoria, the outstanding successes and the failures parallel each other closely and, consequently, little comfort can be derived from our apparently decisive findings on our best students.

Of the several physical findings considered it has been found that in each instance the percentages of successes and of failures have been so nearly equal in both the groups most nearly approaching the ideal and in groups most nearly approaching disqualifying limits as adequately to substantiate the statement that, within qualifying limits at least, differences in physical findings considered bear no relation to students' success or failure. It also follows, therefore, that it is entirely justifiable to assert that the present physical standards are not too lax. As has been said before, the question of whether or not they are too rigid must be left for further study and investigation.

What is it then, that constitutes the deciding quality or qualities in a successful candidate? Is it a mental state? Is it a physiological entity, the speed of reaction time? Certainly it is apparent that if we are to attain a high degree of ability in selecting our successful candidates we must search, not for further physical restrictions, but rather for more comprehensive methods of personality study and of estimating and evaluating the speed of reaction time for, most likely, it is in either or both of these fields that the secret lies.

CONCLUSION

1. *Within qualifying limits*, no correlation exists between physical findings and ability to learn to fly.
2. Such physical findings are no indication of aeronautical adaptability.
3. The physical standards now required are not directed toward adaptability and neither increases nor decreases a student's chances to qualify as a pilot.
4. Aeronautical adaptability must be determined through neuropsychiatric examinations.

NOTE.—Attention is invited to the fact that this analysis and these conclusions apply only to variations in physical qualification which are *within allowed limits*.

Many of the physical disqualifications for duty involving flying are disqualifying because they are potential causes of crash or inability to pilot a plane.

SIMPLIFIED REBREATHES PROCEDURE¹

By WINFRED DANA, Lieutenant, Medical Corps United States Navy

There follows an exposition of two means for simplifying the procedure of the rebreather examination, and incidentally of reducing the personnel required for conducting it. The clinician was perforce eliminated when one of the two medical officers attached

¹ From U. S. naval air station, Hampton Roads, Va.

to this station went on leave. Inasmuch as our experience has indicated that many subjects are taken off by the clinician due to impending or beginning cardiac inadequacy, even before an uncontrolled drop of blood pressure had occurred, it seemed essential for the single flight surgeon conducting the examination to be constantly in touch with what might be going on behind the sternum. The clinical criteria for terminating the run, in the absence of uncontrolled drop in the systolic or diastolic blood pressure, have almost always been adduced by means of the stethoscope, and comprise mainly (1) fetal rhythm, (2) absence or pronounced weakening of the second sound, and (3) arrhythmias (usually frequent extrasystoles; occasionally fibrillation). This in spite of the modern day tendency to minimize the value of Laennec's instrument. The writer therefore, sitting behind the target box, felt the need of constant stethoscopic communication with the subject's heart, and devised the following means: A section of 32/1000 gauge spring steel, $1\frac{1}{2}$ inches wide and 22 inches long is heated and bent to form a fairly tight single loop or U, and in such a manner that one end extends 2 inches further from the center of curvature than the other. Across the end of the longer straight arm, and at right angles to it, is riveted a section of similar spring steel, 4 inches in length (A-B). The short arm is cut in a longitudinal direction (C-D) so as to be able to receive and hold a short adjustable extension (E-F), the face of which is shown in the diagram. The extension is held at any desired length on the short arm by means of a thumb screw. Almost at the end of the extension a hole is drilled just large enough to receive easily the metal tube from the diaphragm attachment of a Bowle's combination stethoscope. The entire instrument, except the extension and the portion C-D of the short arm, is carefully, but not thickly, padded with gauze, and a chamois cover is sewed on. (Fig. 1.) When the device is applied over the left shoulder the cross piece (A-B) lies flat against the lower portion of the scapula, and the diaphragm may be applied by means of the extension to any desired area of the precordium. It may be so adjusted as to fit only sufficiently closely to remain in place and will not then produce any material interference with the deepest respiration. It is not uncomfortable to the subject.

Flexible tubing several feet in length connects the diaphragm on the subject's chest with the stethoscope earpieces worn by the psychologist, who now becomes also the clinician.

Figure 2 shows the method of conducting the examination with the stethoscope holder in position.

The writer has for a long time felt that our method for determining the oxygen percentage remaining in the tank at the expiration of the run was needlessly laborious and time consuming. For, after

all, we have a measured quantity of gas (52 liters) in the tank at the beginning of the run, the same as we have a measured quantity of gas in the Henderson-D'Orsat apparatus before we run this gas through the pyrogallic solution; and during the run the subject is

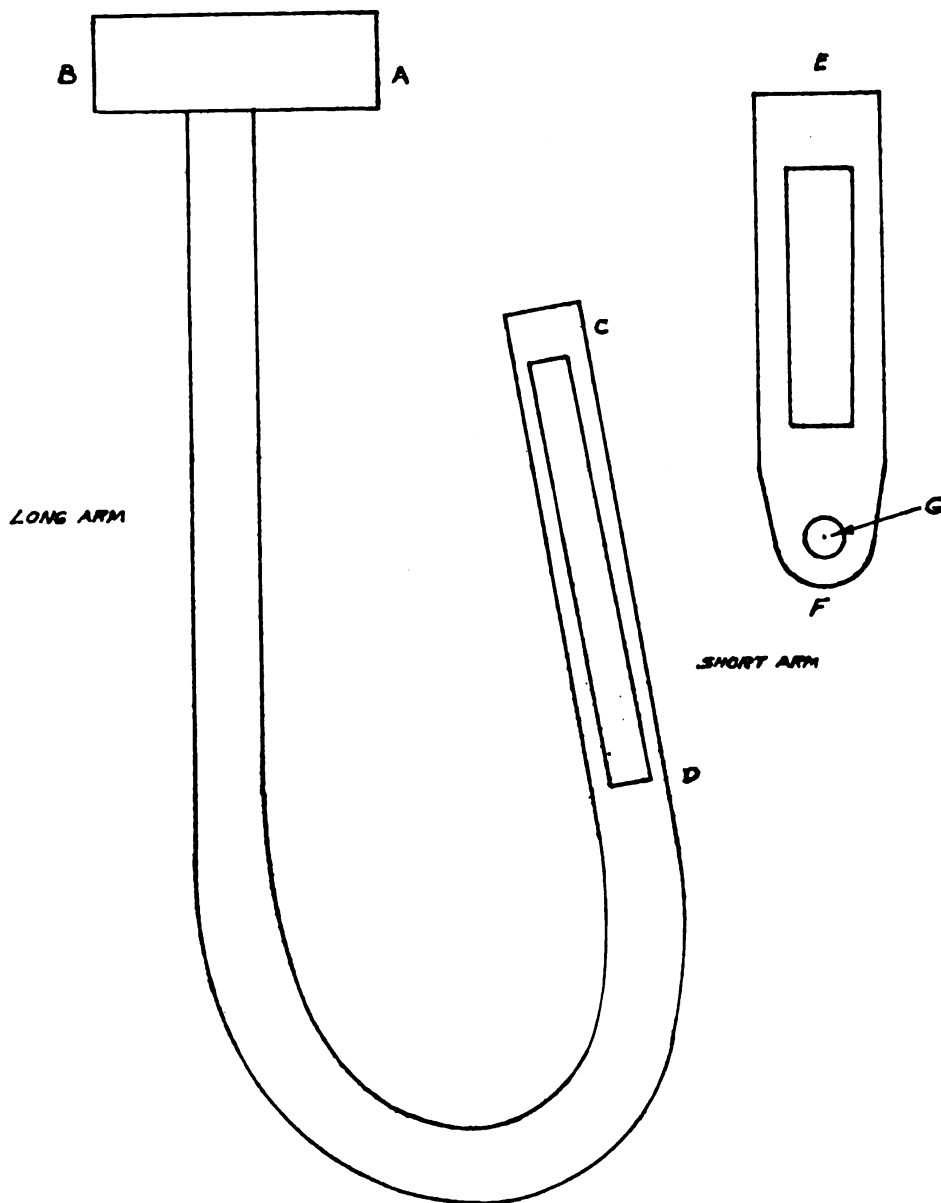


FIGURE 1

playing very much the same rôle as does the pyrogallic solution during the gas analysis; i. e., taking out oxygen and nothing else from the gas mixture. It is true of course that CO_2 is removed from the tank contents by the cartridge during the run, but its volume is small enough to be negligible, about 0.0156 liters.

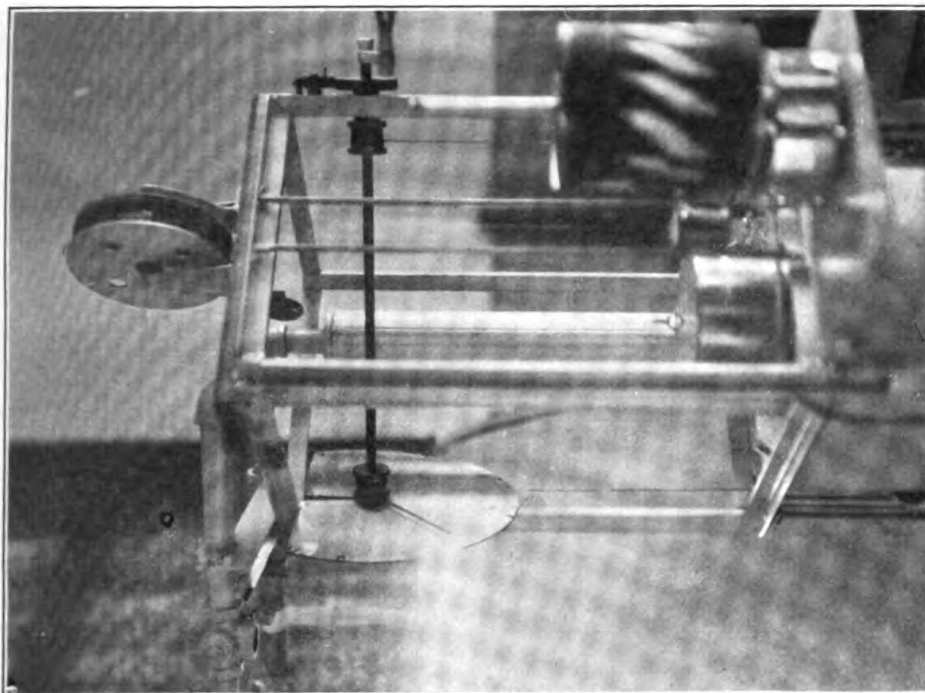


FIG. 4.—APPARATUS FOR MEASURING VOLUME OF GAS IN TANK. (DANA)

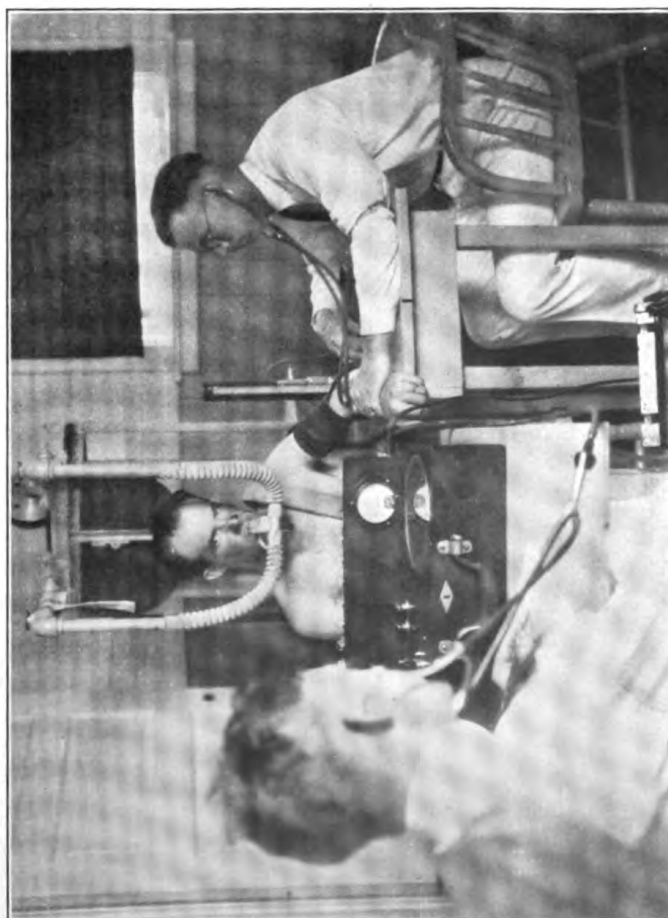


FIG. 2.—CONDUCTING REBREATHING TEST WITH STETHOSCOPE HOLDER IN POSITION. (DANA)

It was also thought, when first considering the possibility of direct measurement of the volume of oxygen removed during the run, that probably the cartridge would remove from the tank contents a material and variable volume of water vapor, the sodium hydrate being hygroscopic. In order to determine the amount and the constancy of error due to this source, a simple means was improvised for artificially passing the contents of the tank through the cartridge. (Fig. 3.)

Two gallon jugs were connected in such a way that when jug No. 1 was filled its contents could be syphoned into or out of jug No. 2 by

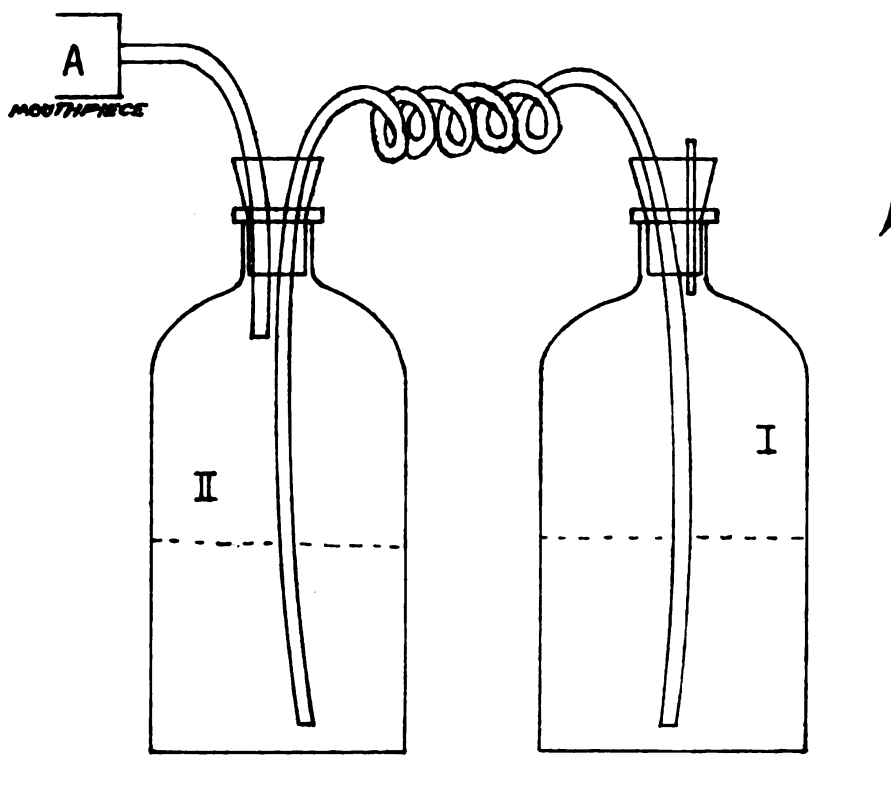


FIGURE 3

raising or lowering. A layer of liquid petrolatum was poured over the water in jug No. 2 so that vaporization would not occur. The air space in jug No. 2 now being alternately increased and decreased by lowering and raising jug No. 1, and the air space in jug No. 2 being in communication with the rebreather mouthpiece, and all other apertures closed, jug No. 2 acts as an artificial lung, and alternately abstracts gas from the tank and sends it back into the tank through the cartridge. Liquid petrolatum was poured over the water seals of the rebreather also, to prevent vaporization. The run is begun and ended with the fluid level in the two jugs exactly even and at a marked level on the wall of jug No. 2. After "rebreathing"

the tank contents in this manner on several occasions for periods as long as one hour (over twice the duration of a normal run) and finding that at the end of the run the volume of gas in the spirometer can remains unchanged within the limit of our measurement (1 deciliter) it was decided that the volume of normal tank contents of any and all kinds removed by the cartridge is, for our purpose, negligible. So, if we only have a means of measuring, fairly accurately, the volume of gas left after the run, then subtracting this volume from 52 liters, we will have, practically, the volume of oxygen consumed by the subject. It is then simple to determine the percentage remaining in the tank. As an example of the arithmetic, the volume of oxygen in 52 liters of air is 52 times 0.2093, or 10.88 liters. Suppose at the end of the run the volume of gas remaining is 44 liters. Then 8 liters of oxygen have been consumed; 2.88 liters remain in a gaseous mixture totaling 44 liters. The percentage of O_2 remaining in the tank is expressed as 2.88 divided by 44, or 6.6 per cent. Computation is made only to the closest tenth of 1 per cent.

In order to use this method it is necessary to have a means of measuring the volume of gas left in the tank after the run with greater accuracy than on the liter scale provided with the apparatus. In order to accomplish this, a simple meter tank dial has been prepared and fixed to the machine in such a position that a 6-inch pointer riding on the rotary tank support will indicate the reduction in tank volume on the dial in deciliters. The accompanying picture is self-explanatory. (Fig. 4.) The procedure is very simple with this method. Suppose the tank dial shows at the end of the run 41.2 liters. This is not all the gas in the system, for a variable amount also remains in the spirometer can. Now (1) swing the spirometer dial clockwise to the mark zero; (2) open the valve from the tank to the mouthpiece, and (3) depress the spirometer can fully. Read from the spirometer dial in deciliters the amount of gas which the can contained. Add this amount to the tank dial reading and you have the total volume of gas remaining in the system at the end of the run.

Since we always start a run with 52 liters of air it has been simple to prepare a table of readings at the end of the run, and corresponding oxygen percentages. (Table 1.) The whole determination may be done in less than half a minute and the subject is told his rating and ceiling as soon as the sphygmomanometer technician has recorded the final three normal readings. It must be emphasized here that the chance for a very large error exists if the operator is not careful to start, and particularly to terminate, the run at the very end of the subject's expiration. This is essential in order to avoid crediting the subject with having consumed a considerable volume of oxygen which is really represented by air in the lungs. It is not

difficult to start and stop the run very nearly at the extreme end of expiration, for there is always a brief respiratory pause at this phase. Apparently too, the amplitude of succeeding phases of the respiratory act are very nearly equal. The best way to insure terminating the run at the proper time is to watch carefully the excursion of the spirometer can, and close the valve when it pauses at its high level. That it is not difficult to do this is evidenced by the fact that on several occasions oxygen percentage readings obtained by this method, as compared with Henderson-D'Orsat readings, have varied only about 0.5 per cent; which is as closely as different technicians using only the latter method usually agree.

TABLE 1

<i>Volume reading</i>	<i>Per cent oxygen</i>	<i>Volume reading</i>	<i>Per cent oxygen</i>
46.0	10.6	44.6	7.8
45.9	10.4	44.5	7.6
45.8	10.2	44.4	7.4
45.7	10.0	44.3	7.2
45.6	9.8	44.2	7.0
45.5	9.6	44.15	6.9
45.4	9.4	44.1	6.7
45.3	9.2	44.0	6.5
45.2	9.0	43.9	6.3
45.1	8.8	43.8	6.1
45.0	8.6	43.7	5.9
44.9	8.4	43.6	5.7
44.8	8.2	43.5	5.5
44.7	8.0		

NOTE.—If reading of deciliters is long, add one-tenth of 1 per cent; if reading is short, subtract one-tenth of 1 per cent.

It is also urged that flight surgeons who may contemplate using the method herein outlined recalibrate their rebreather machines if they have not already done so personally. Since this entire method is based upon starting with just 52 liters of air, any great discrepancy in the original tank content will naturally vitiate the result.

The writer believes this method to be sufficiently accurate for our purpose; to be more uniform in results than the Henderson-D'Orsat method is in the hands of most technicians. Possibilities of error due to leaks in rubber tubing, connections, and glass stopcocks, deteriorated solutions, etc., are eliminated.

The rebreather test is not considered a particularly accurate altitude classification method; but it is a good rough gauge and it is the best we have. In addition it has often demonstrated its value in bringing to the fore slight, early, or "potential" circulatory impairments, those conditions which become apparent only under such a strain as gradually increasing anoxemia, and are hence not detected during the routine physical examination.

**PHYSIOLOGY OF RESPIRATION IN RELATIONSHIP TO THE PROBLEMS OF
NAVAL MEDICINE¹****PART V**

By **EUGENE F. DU BOIS**, captain, Medical Corps, United States Naval Reserve; Medical Director, Russell Sage Institute of Pathology; Associate Professor of Medicine, Cornell University Medical College

NOXIOUS GASES AND PROTECTIVE DEVICES

It is not within the scope of this paper to discuss in detail the various poisonous gases used in warfare. We are more concerned with their general effects on respiration and with the principles involved in the construction and use of protective devices. For the general aspects of chemical warfare the reader is referred to books by Vedder (1) and Fries and West (2). The naval aspects of the subject have been well covered by Brown (3) in a recent number of this journal. The physiological and toxicological effects of noxious gases are fully discussed in the excellent monograph by Haggard and Henderson (4) which is quoted so often in the following pages.

In civil life there are many industries in which the workmen are exposed to the effects of poisonous gases. Most of these gases will probably never occur on shipboard and we can therefore leave certain of them out of consideration. One is tempted to dismiss at once the whole catalogue of mine gases because the naval man has little to do with mines. This, however, would be foolish because there are many lessons to be learned from mine disasters, and the literature published by the Bureau of Mines is of the greatest importance. Many of our ships store coal in poorly ventilated compartments and any fire in any closed compartment on shipboard may produce conditions similar to those found in mines after a fire or explosion. The Bureau of Mines has always taken great interest in protective devices and the Navy has much to learn from their methods of inspecting apparatus and training crews for rescue operations.

The gases that may occur in mines are both interesting and important. Carbon dioxide (CO_2) results from the burning of lamps, fires, explosions, or from the slow combustion of decaying timber, freshly broken coal, or pyrites. Carbon monoxide (CO) is formed by fires or explosions when the oxygen supply is insufficient to permit complete combustion. Miners test for this poisonous gas by carrying canary birds in cages, since little animals are more susceptible than man to this gas because their metabolism, and consequently their respiration, is much greater per unit of weight. The rapid

¹ From the Russell Sage Institute of Pathology in affiliation with the Second Medical (Cornell) Division of Bellevue Hospital, New York. Parts 1, 2, 3, and 4 appeared in the United States Naval Medical Bulletin, 1928, 26, Nos. 1, 2, 3, and 4.

breathing quickly saturates the tissues in their small bodies. Mice are not quite so sensitive as canaries and do not show the effects so clearly. The first symptoms manifested by the bird are increased rate of breathing, often accompanied by opening of the mouth, fluttering, unsteadiness on the perch, and then unconsciousness and death (5) (6).

Cockroaches and other animals without hemoglobin are not affected by carbon monoxide, which is poisonous only because it combines with hemoglobin. There is one very useful chemical test for carbon monoxide, the Burrell. By means of a small hand syringe a measured amount of the air to be tested is blown through a tube which contains fuming sulphuric acid and iodine pentoxide on granular pumice. A greenish color develops which is proportional to the concentration of the CO. In making tests for carbon monoxide we must remember that the air may be worse near the level of the head than at the level of the waist.

The physiological action of carbon monoxide will be discussed later, but I wish at this time to bring out the fact that miners, or rather physiologists working with miners, have devised valuable tests which may be of great service on shipboard. Many a sailor has lost his life when bravely entering a compartment which contains an unknown amount of carbon monoxide.

Carbon monoxide is the most dangerous of mine gases. Methane (marsh gas, fire damp, CH_4) is not poisonous, but it dilutes the good air and in certain concentrations is explosive. Methane is a product of the decomposition of carbonaceous matter with the exclusion of air and in the presence of water. It is occluded in coal and may be given off from broken coal taken from certain "fiery" mines. Its presence is detected by the changes in the flame of the miner's lamp.

Hydrogen sulphide (H_2S , "stink damp") may be produced by the burning of black powder and other explosives. Oxides of nitrogen may be formed when nitroglycerine, blasting gelatin, or other high explosives burn rather than explode. Both hydrogen sulphide and the oxides of nitrogen are highly toxic, the latter showing a delayed action from lung irritation with resulting edema. It is sometimes difficult to determine whether the miner has been poisoned by these gases or by carbon monoxide which is usually formed at the same time.

The so-called "fire damp" of mines is methane. "White damp" is carbon monoxide. "After damp" or "black damp" is a mixture of gases remaining in a mine after a fire or after an explosion of "fire damp." On the average it contains 10 to 20 per cent of carbon dioxide and 85 to 90 per cent of nitrogen, and is irrespirable because it contains so little oxygen. It may contain a high percentage of

CO. Miners detect "black damp" by means of the miner's lamp, which will not burn in an atmosphere containing less than 16 or 17 per cent oxygen. An acetylene lamp will burn till the oxygen percentage falls to about 12.

An oil lamp or a candle gives ample warning of a fall in oxygen in mines, because a man can live in an atmosphere containing as little as 10 per cent of oxygen at sea level, but at high altitudes this does not hold. As we emphasized in a previous chapter, man responds to the partial pressure of a gas; that is, the percentage of the gas multiplied by the barometric pressure minus the partial pressure of water vapor. A candle or lamp flame, on the other hand, responds to the percentage of the gas without much reference to the barometric pressure. A candle can burn at altitudes which will support human life with difficulty because, although the percentage of oxygen there is normal, the partial pressure is much lower than at sea level. Under a pressure of four atmospheres a man can live comfortably in 5 per cent oxygen, whereas the lamp would not burn unless there were 16 or 17 per cent.

Carbon monoxide (CO) is not only the most dangerous gas in mines but it is also the most dangerous in civil life. It causes the deaths of many firemen who enter rooms where the combustion has been incomplete from lack of oxygen. The gas is treacherous because it causes no irritation to the nose or throat and its slight garlic-like odor is never noticed on account of the almost invariable presence of substances with stronger smells. A charcoal fire or oil lamp burning in an inclosed space may produce enough carbon monoxide to be dangerous. The Arctic explorer Stefansson, in one of his books, tells how he and his companion nearly lost their lives in this manner while living on the polar ice floe. The gas from blast furnaces contains from 24 to 30 per cent of carbon monoxide. The smoke from coal fires in stoves or heating plants contains an amount of CO which depends upon the draft, and if this is impeded the percentage may be high. Leaky flues and cracks in the furnaces of hot-air heating plants may cause chronic poisoning, and I have seen several cases of unexplained illness recover rapidly when such leaks were mended. Everyone has heard of the dramatic deaths caused by the carbon monoxide in the exhaust gases of automobiles. Henderson and Haggard (4) estimate that an automobile may produce one cubic foot (28 liters) per minute per 20 horsepower. This, they say, is sufficient to render the atmosphere of a single-car garage deadly within 5 minutes if the engine is run while the garage doors are closed.

For the last 18 years the writer has been working on the medical wards of one of the four divisions of Bellevue Hospital in New

York City. Hardly a week has passed without at least one case of illuminating-gas poisoning, and often one can find in the wards whole families either dying or slowly recovering from the effects of this poison. Every family in New York is living in rooms which can be made lethal by small breaks in the pipes or leaks in the gas cocks.

The original form of lighting gas, coal gas, made by the destructive distillation of coal, contains 4 to 8 per cent of CO, and this is the form used in England and on the Continent. Most American cities are supplied with a mixture which consists chiefly of water gas, which is made by passing steam over heated coke, and this contains 20 to 30 per cent CO. If a gas stove is burning with a good blue flame practically all the carbon monoxide is consumed, but if it is cooled by a cooking utensil some carbon monoxide may escape and some may be formed from other gases. A gas burner is dangerous when it "snaps back" and burns at the hole where it is mixed with air.

Fortunately for the safety of our people, the ordinary dwelling houses are far from air-tight even when all the doors and windows are closed. Haldane (7) describes some experiments which he made with water gas in 1899. He found that when a gas cock was opened in an ordinary room the gas collected near the ceiling and diffused into the room above. If the windows were much colder than the rest of the rooms this caused currents of air, which made a more uniform mixture. Differences of temperature between the interior of the room and the outside air or differences in pressure due to wind caused the passage of large amounts of air through the walls. Haldane calls attention to the fact that if you close the doors and windows of a room and seal all visible cracks a fire will still burn briskly and large quantities of air will pass up the chimney. Even brick, stone, and cement walls are permeable to air. Nevertheless, in spite of all this interchange of air through walls, dangerous concentrations of illuminating gas can occur from relatively small leaks, and many of our hospital patients are brought from rooms where the smell of gas is not strong. Most of our cases are accidental, some are the indirect result of intoxication, some are suicidal. If a man with suicidal intent disconnects the rubber gas pipe from the stove and inhales a few breaths of pure illuminating gas it is usually impossible to save his life.

Carbon monoxide is poisonous because it combines with hemoglobin to form CO hemoglobin, which will not transport oxygen to the tissues. In addition, this carbon monoxide hemoglobin in the blood seems to affect the dissociation curve of the remaining oxyhemo-

globin so that it gives up its oxygen to the tissues less readily than normal. Thus, a man with half of his hemoglobin in the form of CO hemoglobin has more difficulty in performing exercise than an anemic man whose total hemoglobin is 50 per cent. Hemoglobin takes up carbon monoxide greedily from the air even when it is present in very small amounts because its affinity for CO is about 300 times as great as for O₂. Thus, if we consider that the proportion of dry oxygen in the alveolar air is 14 per cent we know that a man will saturate half of his hemoglobin with carbon monoxide if he breathes continuously for a sufficient time air containing 0.047 per cent of this gas. ($\frac{14}{300} = 0.047$.) Haldane (7) and others have calculated the rates of absorption and elimination for various percentages of the gas in air. As in the case of other gases, the substance is absorbed more rapidly at first and then more and more slowly as the blood becomes saturated. It was formerly supposed that carbon monoxide hemoglobin, once formed, was a stable compound, but this is not the case since the hemoglobin loses its CO when exposed to alveolar air containing more oxygen and less carbon monoxide than the mixture at which the blood was saturated. That is why patients usually recover when removed to fresh air and why they recover more rapidly when given air enriched with oxygen.

Haldane, who never hesitates to make dangerous experiments on himself, describes his symptoms when different percentages of his blood were saturated with carbon monoxide. There was no particular effect until 20 per cent saturation was reached, when he noticed on running upstairs slight dizziness and some extra palpitation and hyperpnea. At 30 per cent, even at rest, there was a slight increase in pulse rate, deeper breathing, and, after running upstairs, dizziness, dimness of vision, and abnormally increased breathing and pulse rate. At 40 per cent these symptoms were more marked and exertions had to be made with caution for fear of fainting. At 50 per cent saturation there was no real discomfort during rest but the breathing and pulse were rapid, vision and hearing impaired, movements were uncertain, and he was unable to recognize objects or estimate their distance correctly. His intelligence was probably greatly impaired. He could hardly rise from a chair without assistance and on one test when the saturation reached 56 per cent he could hardly stand. After each of these experiments the saturation of the blood fell rapidly when fresh air was breathed; and within three hours the saturation had fallen below 20 per cent. Henderson and Haggard (4) estimate that a saturation of 60 to 70 per cent causes unconsciousness, respiratory failure, and death if the exposure is long continued. Eighty per cent is rapidly fatal. They give the following table which will be of great service when combined with analyses of air to which men are exposed for any length of time:

Physiological response to various concentrations of carbon monoxide

	Parts of carbon monoxide per million parts of air
Concentrations allowable for an exposure of several hours.....	100
Concentration which can be inhaled for 1 hour without appreciable effect.....	400-500
Concentration causing a just appreciable effect after 1-hour exposure.....	600-700
Concentration causing unpleasant but not dangerous symptoms after 1 hour of exposure.....	1,000-1,200
Dangerous concentration for exposure of 1 hour.....	1,500-2,000
Concentrations which are fatal in exposures of less than 1 hour.....	4,000 and above.

In fatal cases the carbon monoxide-hemoglobin can be determined by analysis of the blood many days after death. Haldane examined the bodies of men who had been killed in colliery explosions and found that the saturation of the hemoglobin with CO was usually about 80 per cent, but in some cases not more than 60 per cent. Patients who have been seriously gassed sometimes live for several days without recovering consciousness, although all the carbon monoxide has disappeared from the blood. This is the result of profound injury to the brain in the region of the lenticular nucleus. Many patients develop pneumonia after recovering consciousness.

The reader who has studied the previous chapters of this series of articles on respiration must have been impressed with the striking similarity of the symptoms of carbon-monoxide poisoning and simple anoxemia. As a matter of fact, carbon monoxide poisoning is nothing but one form of anoxemia. The blood can not transport enough oxygen to the tissues. The gas has no other poisonous action. We have already stated that animals without hemoglobin, such as cockroaches, can live for days in an atmosphere rich in carbon monoxide. Haldane proved the nonpoisonous nature of the gas itself by an ingenious experiment on a mouse. He placed the animal under a pressure of two atmospheres in a mixture consisting of two parts of oxygen and one part of carbon monoxide. This saturated the hemoglobin almost completely with CO but there was so much oxygen in simple solution in the blood that it fully supplied the tissue needs of the body. The mouse remained quite normal except that it became tired more easily than usual when it climbed up the jar.

We must use our knowledge of the physiological action of carbon monoxide in directing the treatment of men who have been exposed to its effects. Of course the first thing to do is to remove the patient as soon as possible to a room containing fresh air. We must always remember that rescue work is dangerous and that no amount of good

intention or bravery will protect the rescuer from the gas. Unless the room can be ventilated immediately the rescuer should wear some efficient protective device and tie a rescue line firmly on his body. It is better to carry the patient to a warm room than to leave him in the open air since gassed patients do badly in cold air and the percentage of oxygen in any decently ventilated room is not appreciably lower than in outside air. The clothing around the neck should be loosened and the patient wrapped in warm blankets. Hot water bottles must be used with great caution since they often cause burns in unconscious patients. There are no medicines which will do any good and most of those usually employed do great harm. The patient must be kept as quiet as possible and it is dangerous to try to stimulate respiration by beating him or making him walk. Venesection and transfusion are of value only in the first hour after removal from the gas and it is only a marvellously efficient service that can finish a transfusion within an hour of the first alarm without sacrificing the more important therapeutic measures.

Yandell Henderson has introduced and perfected the most satisfactory method of treatment. He administers to the patient as soon as possible a mixture containing 95 per cent of oxygen and 5 per cent of carbon dioxide. The carbon dioxide acts as a respiratory stimulant and causes a great increase in the depth of breathing. The oxygen by its mass action causes a much more rapid breaking up of the carbon monoxide-hemoglobin combination than would atmospheric air. This mixture of carbon dioxide and oxygen is readily obtainable in cylinders and it can be given by means of a good face mask with inlet and outlet valves or much less efficiently by rubber catheters inserted far into the nose. The ordinary funnel held over the face is of practically no value. The best apparatus for its administration is the H. H. inhalator of Henderson and Haggard (6), which consists of two metal cylinders containing the gas mixture, a reducing valve, a rubber bag which serves as reservoir, and a face piece with good valves. This inhalation is continued for one to three hours after the patient has been taken out of the poisonous atmosphere, a time which is usually sufficient to remove practically all the carbon monoxide from the blood. The patient must be kept in bed for several days on account of the danger of pneumonia.

We have given a great deal of space to a consideration of carbon monoxide on account of its importance in naval as well as civil life. Other forms of bad air are encountered in the most unexpected places. Men are sometimes asphyxiated when digging wells by a mixture similar to the "black damp" of mines. Carbon dioxide and nitrogen exude from the soil, particularly when the barometer is falling. Haldane speaks of one place where an engine house on top of a well

became unsafe whenever the barometer was falling. This is a point to be remembered in mining and sapping operations.

In the closed compartments of ships the air is liable to become foul owing to the process of rusting, which abstracts oxygen, or to the drying of paint, which absorbs oxygen. There may also be an adsorption of oxygen by certain articles of the cargo or a utilization of oxygen in the slow combustion or decomposition. Certain grades of coal may give off fire-damp (CH_4) or carbon monoxide (CO). One of the most fatal gases on shipboard is cyanogen.

Hydrocyanic acid gas and cyanogen are used extensively in ridding ships or dwelling houses of rats, bugs, and mosquitoes. There are many fatalities because the gas is practically odorless and highly lethal. The cyanides are protoplasmic poisons and inhibit tissue oxidation, probably combining with catalysts of the cells containing iron or sulphur. The blood may carry plenty of oxygen to the tissues, but if they are unable to use it they die rapidly of asphyxia. Henderson and Haggard (4) give the following table taken from Kobert:

Physiological response to various concentrations of hydrocyanic acid gas

	Parts of hydrogen cyanide per million parts of air
Slight symptoms after several hours' exposure.....	20-40
Maximum amount that can be inhaled for 1 hour without serious disturbance.....	50-60
Dangerous in 30 minutes to 1 hour.....	120-150
Rapidly fatal.....	3,000

In the ordinary case of acute poisoning the man falls after a few breaths of the atmosphere contaminated with the gas. Death follows in 6 to 8 minutes. Protection is easily afforded by suitable gas masks. The Chemical Warfare Service at Edgewood Arsenal has introduced a great improvement in fumigation methods by adding cyanogen chloride to the hydrocyanic acid gas. The chloride helps kill the vermin, and it gives immediate warning of its presence by its irritation to the respiratory tract.

WAR GASES

A new era in modern warfare began in April, 1915, when the Germans first used chlorine. From that time until the end of the Great War there was a constant development of new gases and new methods of using old gases. For reasons of stern necessity there was a corresponding improvement in methods of gas defense and neither side dared employ a gas for which it had no protection. The chemical side of the war became a feverish search for gases for which the enemy was unprepared or for methods of securing concentrations

that would break down the defenses. All forms of gas masks interfered with the efficiency of the wearers and it was therefore desirable to force the enemy to wear gas masks as much of the time as possible. The easiest gas masks were those with the smallest canisters but these gave protection only against a limited number of gases in low concentrations. In order to protect against many gases or high concentrations it was necessary to employ large canisters and these caused a serious impediment to respiration. Toxic smokes were then introduced because the fine particles were able to penetrate the ordinary canisters. This necessitated the use of smoke filters which offered a greater impediment to breathing. Next mustard gas was used because in addition to being highly toxic to the respiratory tract it caused burns of the skin. Complete protection against this type of toxic agent required a suit of impermeable clothing which hampered the activity of the wearer. In this present article we are chiefly concerned with the various protective measures and the physiological principles which determine their design.

Henderson and Haggard (4) divide the noxious gases into the following four groups:

1. **ASPHYXIANTS.**—These do no direct injury to the respiratory tract.
2. **IRRITANTS** which injure the surface tissues of the respiratory tract and thus induce inflammation of the air tubes and of the lungs themselves.
3. **VOLATILE DRUGS AND DRUGLIKE SUBSTANCES.**—They have a druglike action after they have been absorbed through the lungs.
4. **INORGANIC AND ORGANO-METALLIC GASES.**—These also act only after absorption into the blood.

The asphyxiants were not of much service in gas warfare because high concentrations are required to produce toxic effects. Carbon monoxide and hydrocyanic acid gas diffused too rapidly and the latter proved to be less toxic for men than the experiments with dogs had indicated. The irritants were the most important group. Those that were very soluble in water, like chlorine, exerted their action all along the respiratory tract. Those that were less soluble, like phosgene, acted chiefly on the alveoli of the lung, causing pneumonia and edema. This edematous fluid filled the lungs and interfered with the passage of gases between the respired air and the blood in the lung capillaries. CO_2 being more soluble than O_2 , passed through the edema fluid more readily, so the chief trouble was due to anoxemia and the patients exhibited an ashen gray cyanosis and often fell dead when they exerted themselves and thereby increased the demand for oxygen absorption. The lachrymatory gases were also important because even in very low concentrations they forced the wearing of gas masks.

The group of volatile drugs and druglike substances includes the anesthetics, which are not within the scope of this article. The group

also includes gasoline, which sometimes causes serious poisoning when men are exposed to its fumes in closed compartments. The nitrites are of importance in certain industries.

The inorganic and organo-metallic gases of Group 4 are not often encountered in the Navy. Mercury vapor emanating from the surface of liquid mercury, especially at high temperatures, poisons workers in certain industries. Phosphorous is notorious. Lead often causes poisoning and men working with the lead plates of batteries may suffer. The use of tetraethyl lead in gasoline to prevent knocking is spreading rapidly and may become a source of danger to the naval personnel. The pure substance, before it is mixed with gasoline, is so extremely toxic that a little of it spilled on the hands may kill a man.

The history of gas-mask development has been summarized by Captain Barker of the Edgewood Arsenal (8). As early as 1848 masks for the protection of workmen were patented in the United States. Long before the war there were efficient self-contained breathing machines which enabled rescue parties to enter mines or compartments in which the air was absolutely irrespirable. The first protective devices used in the war were simple pads soaked in sodium hyposulphite. Flannel helmets were next used and then came the development of the modern type of mask. The Germans from 1915 until the end of the war held to a relatively simple face mask with a snout canister. They breathed in and out through this canister. Toward the end of the war the facepiece was made of impregnated leather, the eyepieces were nondimming, and the canister had three layers of protective chemicals with a snap cover of absorbent cardboard as protection against smokes. Barker calls this the most effective mask developed during the war. It had the disadvantage of a fairly large "dead space" and at each inspiration the man breathed in part of the air which he had just expired. It had the great advantage of simplicity and comfort and there was no tube to hamper the movements.

The British, in 1916, issued the box type of respirator with a canister carried on the chest and a long flexible tube which led to a mouthpiece inside a rubberized face mask. All breathing was through the mouth and the nose was closed by a nose clip. The man inspired through the canister and expired through a flutter valve of a type designed by Major Sadd.

This mask afforded a high degree of protection, but was uncomfortable and somewhat clumsy. There was also difficulty in preventing the fogging of the eyepieces on account of the moisture from the warm face. The French, in 1916, introduced the Tissot box respirator with an ingenious system of tubes so arranged that the fresh air drawn through the canister passed over the eyepieces, thus prevent-

ing dimming. This made it possible to get along without the uncomfortable nose clip. The apparatus was still unwieldy on account of the large canister and the French in 1917 and 1918 used a mask which was modeled after the German snout type. The United States Army at first copied the British box respirator and later adopted the Tissot type with several improvements. The Navy at first copied the German mask, adding an expiratory valve, and then designed a modified Tissot mask with the canister on the head so that it would not be in the way while serving guns.

The present submarine gas mask (9) (submarine respirator—Mark I, formerly NS—Mark I) resembles the German snout-type mask, but it has the British expiratory valve and it employs the Tissot principle of leading the fresh air from the canisters over the inside of the eyepieces so as to prevent fogging. The Navy mask for general issue (10) (Navy diaphragm—Mark I, designated ND—Mark I) replaces the Army 1919 mask, called the A mask in the Navy. Its chief advantage over other masks is that it allows its wearer to talk and be understood by others. So far as protective devices are concerned it is similar to the A mask.

There are certain general principles of design which apply to all gas masks. In the first place the mask must be almost absolutely air-tight. If it does not fit the face snugly there will be leaks between the skin and the edge of the mask. This danger has to a certain extent been obviated by making the masks in different sizes and by paying a great deal of attention to the shape of the mask and the adjustment of the straps which hold the rubber fabric against the face. Nevertheless there are certain individuals whose faces are of unusual shape and these men are often very difficult to fit properly. Beards offer an almost insuperable difficulty. In any such case where there is a leak around the edge of the face piece or in fact any leak through the fabric itself or through the tubing or canister the wearer is in serious danger. If exposed to a high concentration of poisonous gas a small leak may be the cause of death. With low concentrations the wearer may be saved by the so-called scavenging action of the air which passes through the mask. At each expiration the bad air in the mask is mixed with the air coming from the lungs and most of it washed out through the expiratory valve. As we shall see later this scavenging action is not present in the self-contained type of breathing apparatus used in mine rescue operations.

The canister is the vital part of the mask because it contains the chemicals which remove the poisonous gases. At the present writing there is no gas in warfare or the industries that can not be taken care of by a properly constructed canister. There is even

one canister, the "Universal," which will protect against all gases that may be encountered, but this canister is of necessity large because it contains so many chemicals. The larger the canister the greater is the resistance to breathing and the greater the weight. For these two reasons it is customary to employ smaller canisters that give protection only against those gases which one may encounter under the given conditions. Thus in certain industries it is necessary to protect against only one gas such as ammonia, or chlorine, or carbon monoxide. In chemical warfare we must use means to eliminate lachrymators, irritants, and toxic smokes, but there is no need of taking into consideration ammonia or carbon monoxide. Every effort is made to reduce weight and bulk and resistance. There is a certain irreducible minimum caused by the friction of air on the walls of the tubing, the canister, and the valve at the bottom of the canister. Most of the resistance comes from the chemicals, which must be tightly packed and must be divided into granules small enough to offer the greatest possible surface to the gases. The smoke filters gave much trouble when first used because the smoke particles were so small that they would pass through any but the tightest filters and tight filters offer much resistance to the air. This has been largely overcome by an improvement in the construction of the filters and by a proper increase in the size of the filtering surface.

The Army gas mask has been well described in a recent circular of the Chemical Warfare Service. We can not do better than to quote some of the sections verbatim:

The chemical filling consists of activated charcoal and soda lime. The activated charcoal adsorbs organic vapors such as mustard gas, Lewisite, chlorpicrin, cyanogen chloride, alcohol, benzene, and carbon bisulphide and to some extent, acid gases such as phosgene, chlorine, hydrocyanic acid, and sulphur dioxide. These acid gases are eliminated more effectively, however, by soda lime with which they combine chemically.

The nature of the adsorptive power of charcoal for gases and vapors is not definitely known. It is known, however, that it does not involve an absorption similar to the manner in which water is absorbed by a sponge nor does it appear to involve chemical action, although this theory has been advanced. It would seem that adsorption involves a force or attraction for gases and vapors similar to the attraction of a magnet for iron filings. * * *

There is, of course, a limit to the adsorptive capacity of activated charcoal and further the adsorptive activity decreases as the amount of gas adsorbed increases. Also, some gases are adsorbed more readily than others; as a general rule the more readily the liquid or liquified gas vaporizes, the less readily is it adsorbed. There is thus very little adsorption of air or such gases as hydrogen or carbon monoxide or illuminating gas by activated charcoal.

There are a number of toxic gases such as carbon monoxide and ammonia for which neither the charcoal nor the soda lime of the Army gas mask canister afford protection, although adequate protection against these gases

could be provided if necessary. Silica gel as a canister filling affords protection against ammonia, and Hopcalite, a mixture of oxides of cobalt, copper, manganese, and silver, affords protection against carbon monoxide.

Silica gel and Hopcalite are not employed in the Army gas mask for the reason that ammonia and carbon monoxide can not be effectively employed in warfare. They dissipate so rapidly in the open that the soldier is not apt to encounter dangerous concentrations even if attempts were made to use these gases as chemical warfare agents. Silica gel and Hopcalite are, however, very important components of the canister filling for certain industrial and Navy submarine gas masks. Silica gel is the essential filling for gas mask canisters required by refrigeration plant operators who encounter dangerous concentrations of ammonia; and Hopcalite is employed in gas mask canisters used in coal mines, in fighting fires, and also in submarines where dangerous concentrations of carbon monoxide may be encountered.

During the World War the Bureau of Medicine and Surgery requested the Chemical Warfare Service to devise a mask which would protect against carbon monoxide because at that time there was no substance known which could be employed in gas masks to eliminate this menace to the men in our Navy. The closed compartments of battleships lend themselves to the formation and retention of this gas in any fire and particularly when explosives burn. It is reported that many lost their lives from this cause during the battle of Jutland and that on one vessel several hundred men were fatally affected by the carbon monoxide produced from burning cordite, a propellant explosive. Fortunately we now have protection against this gas, thanks to the labors of chemists in the Johns Hopkins and California Universities. The compound is fittingly named Hopcalite in their honor. It will keep on oxidizing CO indefinitely so long as it remains dry and uncontaminated. This necessity for the removal of moisture is the chief limitation of the reagent but it can be accomplished in the gas mask canister by placing before the Hopcalite a layer of calcium chloride or caustic soda which have great affinity for water vapor. It must therefore be remembered in using such masks that the calcium chloride becomes saturated rapidly in moist atmospheres and that it will be exhausted if the gas mask is used for practice purposes even if no carbon monoxide is present. When Hopcalite is oxidizing carbon monoxide it naturally becomes warm, but in service the concentrations encountered are seldom high enough to make the mask uncomfortable.

The submarine respirator, mark 1, has a relatively small canister, but it protects against carbon monoxide, chlorine, hydrogen chloride, sulphur dioxide, gasoline vapors, oil vapors, carbon-tetrachloride vapors, and industrial smokes, such as those from burning insulation. It does not give complete protection against war gases in the concentrations that may be encountered on the battle field. As the air enters this canister it passes first through a valve, then through a layer of caustic pumice which removes the moisture and protects

the Hopcalite for a period of one and one-half hours and, in addition, neutralizes the acid gases, such as chlorine. After this comes a layer of charcoal, then a smoke filter, a layer of Hopcalite, and a second filter.

All gas masks cause some resistance to inspiration and expiration. With small canisters, when the subject is resting, it may amount to a positive or negative pressure of only 1 or 2 centimeters of water, and this is scarcely noticeable. Henderson and Paul in speaking of mine-rescue apparatus say that the positive pressure should never exceed 5 centimeters (2 inches) water gauge, preferably not 2.5 centimeters, and the negative pressure should never exceed 2.5 centimeters. In some apparatus they had found during heavy breathing adverse pressures of 10 to 15 centimeters water gauge and on one occasion the intolerable negative pressure of 22 centimeters. In all masks there is also a dead space which must be added to the normal dead space of the trachea, bronchi, etc. At the end of expiration the mask is filled with alveolar air and this is drawn back into the lungs during the next inspiration. Thus the wearer never gets a breath of really pure air, but it is always somewhat contaminated like the air of a submarine. In spite of all these drawbacks it is possible to perform hard work for considerable periods while wearing gas masks and various types of mine-rescue apparatus.

In all of the open-circuit types of gas masks the individual depends on the outside air for his supply of oxygen. If for any reason the oxygen of the air in a closed compartment, such as a mine or hold of a ship, has been reduced to 10 to 15 per cent it will be impossible for the wearer to perform any work. It is difficult to give any figures for the exact limits of the reduction of oxygen permissible. In the first place the percentage of oxygen might vary in different parts of the compartment and might be reduced rapidly by a fire. In the second place, the effect of such a reduction would depend on the degree of activity of the wearer and on his powers of adaptation. Sudden reductions in the oxygen content of the air are not tolerated so well as gradual changes. For these reasons it is necessary to abandon the open-circuit apparatus and adopt the closed-circuit type in all cases where there may be a deficiency of oxygen. On ship-board the usual cause of such a deficiency is a fire in a closed compartment. On such occasions the air will also contain carbon monoxide and perhaps other poisonous gases and smokes. Therefore the man who enters such an atmosphere is just as badly off as the diver who submerges himself in water.

If a man does not have to go more than a short distance from the fresh air he can wear a face mask to which is attached a long hose with a portable air pump at the other end. The wearer's activities are of necessity greatly hampered by the long hose, but it gives a

fully adequate supply of air. The simplest form of protective device is the Navy emergency fire hood. This consists of a large loose bag fitted with goggles. When thrown over the head it closes around the neck, entrapping enough air to last a man three to five minutes, depending on his activity. At the end of this time, if he has exhausted the oxygen, he falls unconscious. This particular method of rapid oxygen exhaustion seldom gives a man warning before he faints. The hood can only be used for short dashes into smoke-filled compartments and the wearer should always be provided with a life line.

A great deal of attention has been paid to the designing of more elaborate types of mine rescue apparatus and at the present time there are several closed circuit devices which will permit a man to walk or engage in fairly heavy work for two hours in an atmosphere which is absolutely irrespirable. It would take too long to describe all of these, but the reader who is interested in the details of this subject should obtain the reports of the United States Bureau of Mines and of the British mine rescue apparatus research committee. The United States Navy oxygen rescue breathing apparatus is described in the manual of the Bureau of Construction and Repair. The first practical apparatus seems to have been the "Proto" designed by Fleuss in 1879 and used in the underground fire which followed the explosion at Seaham colliery, 1880-81. This in modified form is still used in many mines and it is relatively simple in construction. There are two oxygen cylinders carried on the back and a large breathing bag on the front of the body. The expired air passes into the forward compartment of this bag and then goes through a loose mass of caustic soda at the bottom of the bag which removes the CO_2 . It next passes up the rear compartment of the breathing bag and then through flexible tubing back into the lungs through a mouthpiece. The tubes leading to and from the mouthpiece are provided with valves and the lungs keep the air circulating without difficulty. Oxygen is supplied at a constant rate of about 2 liters a minute, and if the flow is too great the excess can be discharged through a relief valve. There is also a by-pass on the oxygen cylinder so that the wearer can secure more oxygen if anything happens to the automatic adjustment. A pressure gauge tells the amount of gas left in the cylinders. One disadvantage of this apparatus is that the caustic soda does not remove the carbon dioxide very efficiently unless it is frequently shaken. The total weight is about 36 pounds.

The Draeger apparatus looks a good deal like the Proto, but there is only one oxygen cylinder and the CO_2 is absorbed in a metal chamber provided with cartridges containing granules of caustic

potash and caustic soda. The air is kept in circulation by an injector from the high pressure oxygen cylinder which drives the air in the tubing along in the right direction. This machine which is used in many mines has come in for a great deal of criticism, particularly in the first report of the British committee. They have found that the injector sometimes gets choked and that if at any time the man requires a greater volume of air than is kept in circulation by the injector he will either find himself trying to breathe from a flat bag or else be obliged to rebreathe expired air. The most serious hazard is the zone of negative pressure which exists back of the injector. Any small leak in this zone may draw poisonous air into the tubing. The Westphalia or Meco apparatus is similar to the Draeger.

The Weg apparatus, named after its inventor, Sir William E. Garforth, does away with the injector and employs a delicate reducing valve with large diaphragm designed to open during inhalation and close on exhalation. This makes for economy in the use of oxygen. Mr. W. E. Gibbs, of the United States Bureau of Mines, has devised a very fine automatic valve which accomplishes this same delivery of oxygen as it is needed and he has added several other improvements. The oxygen cylinder, absorbing can for CO_2 , and the bellows shaped breathing bag are carried on the back. The United States Navy type oxygen rescue breathing apparatus is similar to the Weg and Gibbs in that it employs a valve which admits oxygen as the breathing bag becomes empty. The CO_2 is removed by a canister of soda lime and a cooler placed next to this prevents the air from becoming too warm. The whole apparatus is carried in front of the body so that it will not cause obstruction in narrow passages. It is much smaller than the apparatus used for mine rescue and it is intended for only one-half hour of moderately hard work instead of two hours. The French Tissot apparatus uses an oxygen valve that can be adjusted by the wearer to the degree of his activity. Tissot removes the CO_2 by means of a solution of caustic potash which is a source of danger in case of accident.

The Brown and Mills aerophore apparatus employs liquid air instead of an oxygen cylinder. As a matter of fact "liquid air" is largely liquid oxygen because the nitrogen evaporates more readily on account of its lower boiling point. When first poured into the rescue apparatus the liquid contains 45 to 60 per cent oxygen and at the end of a 2-hour period the "air" delivered may show 80 to 90 per cent oxygen. Before the apparatus is strapped on the back the liquid air is poured into the receptacle where it is soaked up by calcined asbestos wool. There is no gauge to read and no valve to

get out of order, and this is one of the simplest types of rescue apparatus. Its chief disadvantage is the difficulty of obtaining and storing the liquid air.

There are several dangers connected with almost all of these various forms of rescue apparatus. Any leak may prove fatal and leaks are apt to occur if there is negative pressure in any part of the apparatus. If a little carbon monoxide is drawn into the tubing it is not scavenged out through any expiratory valve as in the case of a gas mask but remains in the circulating air until absorbed by the blood. Any large dead space causes the wearer to inspire air containing much CO_2 . For this reason mouthpieces are advised, though it may be possible to employ face masks if they fit perfectly. Helmets are to be condemned absolutely, as they not only leak but also have an enormous dead space which can not be properly ventilated if the man is exerting himself. Impure oxygen constitutes a common source of trouble. Oxygen supplied by commercial firms may contain 1 to 2 per cent of nitrogen and argon and sometimes even 8 per cent. Oxygen made electrolytically sometimes contains dangerous amounts of hydrogen, apparently on account of sudden shifting of polarity in the electrolytic cells. For ordinary use in medicine or in the industries small contaminations are not important but the case is very different in a closed circuit breathing apparatus used for one or two hours. If in the course of an hour the man uses 100 liters of oxygen and the cylinder supplies 98 liters of oxygen and 2 liters of hydrogen the whole 2 liters of hydrogen will remain in the breathing bag and reduce the oxygen percentage very seriously. It may even cause an explosion. Nitrogen can not explode but it can cause suffocation. For this reason the oxygen used for rescue apparatus should be tested for its purity.

APPARATUS FOR ADMINISTERING OXYGEN

Oxygen has been used therapeutically for many years but without very great success until the latter part of the World War. Then more effective methods of administration were introduced and proved of great help in the pulmonary edema due to irritant gases, especially phosgene. After the war these same methods were employed for the anoxemia of pneumonia and cardiac disease. There are now many forms of apparatus and the reader who is interested in the details of this subject is referred to the books of Haldane, Meakins, and Davies, and the papers of Binger, Barach, Roth, Davies, and Gilchrist.

The primitive method of holding an oxygen funnel over the patient's nose causes an increase of only 2 or 3 per cent of oxygen in the inspired air (total O_2 , 23 to 24 per cent), and this is obtained

only when the flow of gas is vigorous. For all practical purposes this method is worthless since oxygen therapy is of little value unless the inspired air contains at least 30 per cent of the gas. The best results are found when the air contains between 30 and 60 per cent of oxygen and the optimum point seems to be about 40 per cent. The nasal catheter method does not permit us to obtain quite this optimum level but it may raise the oxygen content of the inspired air to 25 to 27 per cent when the rate of flow is 1 liter a minute and to 30 per cent with the vigorous flow of 2 liters per minute. The method is simple but requires some attention. A rubber catheter of small diameter with several small holes in the terminal inch is passed into the nasal cavity until it strikes the posterior surface of the nasopharynx, then withdrawn half an inch and fastened to the forehead with adhesive. The patients seldom object to this and it sometimes helps relieve the cyanosis and subjective distress. A much more efficient method is the face mask of Haldane or Davies and Gilchrist. Oxygen is delivered into a small mask which fits over the nose and mouth. A rubber bag serves as a reservoir in which the oxygen collects during expiration and a pair of valves permits the patient to breathe in from the bag and breathe out through the front of the mask. The only drawback is the annoyance caused by a tight mask over the face and in some cases this makes it impossible to employ the mask for more than a few minutes at a time. Such intermittent therapy is of little value because there are no storage places for oxygen in the body. Barach and others after much experimentation adopted a tent with a large celluloid window which goes over the patient's head and thorax as he lies in bed in the semireclining position. The air is kept in circulation by means of a machine which resembles the Benedict universal respiration apparatus. A rotary blower sucks air from the tent, drives it through soda lime and then through a cooling chamber filled with ice, and then back into the tent. Oxygen is supplied as it is consumed from a high-pressure tank and it is possible in this manner to secure for the patient cool air containing anywhere between 40 and 60 per cent oxygen. Many patients with anoxemia are quickly relieved by this tent and show great distress when it is removed. A few are bothered by the sense of being shut in. The apparatus is efficient but expensive and it requires some experience to keep it working satisfactorily.

The best oxygen apparatus, but by far the most expensive, is the large oxygen chamber which will hold the patient's bed and also give room for the nurse or doctor. The cost of these chambers with their elaborate systems of ventilation and cooling was almost prohibitive until Barach made a relatively simple portable chamber out of aluminum, using very much the same method of air purifica-

tion as is employed in a submarine. At the end and sides of the little room there are coils of pipes through which cold water circulates, cooling the air and thus causing currents which keep the chamber comfortable. Under the bed there are several large trays containing Navy (Wilson) soda lime, and there is enough movement of air to keep the carbon dioxide percentage below 0.5 per cent. Oxygen is admitted from cylinders and the percentage of this gas is easily maintained at any desired point, usually about 40 per cent. The chamber is of excellent design and it works well. It is possible that such a chamber could be improvised out of a stateroom on board a ship. The chief difficulty would be the cooling pipes. The trays for soda lime could be readily provided and the oxygen could be admitted through any hole in the wall. It must always be remembered that in any concentration of oxygen above normal flames will burn more brightly and fires spread more rapidly. There must be absolutely no naked light in any oxygen chamber and absolutely no electrical connection that can possibly start a fire. One patient has already been burned to death in an oxygen chamber.

The use of oxygen in American clinics has been increasing steadily in the last few years. Most of the prejudice against it has been due to the inadequate methods of administration. Clinicians who are fortunate enough to possess good apparatus are enthusiastic because they find that it will tide over a critical period of dangerous anoxemia and furnish to the vital centers enough oxygen to keep them going until the natural processes of recovery or immunity can get the upper hand. Of course there are many cases where oxygen does nothing except prolong life for a few hours. In pneumonia it is not curative, only supportive, but in the course of pneumonia the patient may encounter a period of short duration when the failure of the circulation with its attendant dyspnea and cyanosis threatens a fatal termination. If he can be kept alive during this emergency he still has chances of recovery. Similar emergencies are encountered in cases of heart failure. In carbon monoxide poisoning also the face mask or oxygen tent can be used to administer a mixture of carbon dioxide and oxygen.

For the last 10 or 15 years the public press has been full of the marvelous exploits of "Pulmotors," "Lungmotors," and various other machines which are said to bring the dead back to life. There are on the market many devices which are designed to restore respiration by forcing oxygen into the lungs during inspiration and by sucking it out during expiration. This type of apparatus has been strongly condemned by many committees appointed by Government bureaus. The principle of forcing air into the lungs is unphysiological and is attended by the danger of pneumonia if infected material

is carried down into the lungs. Suction is an unphysiological aid to expiration and does not secure the best ventilation of the alveoli. The chief danger lies not in the apparatus itself but in the strong reliance which is placed upon it by the public and by those in charge of emergency stations. Precious minutes are wasted in waiting for the arrival of the machine and in trying to get it to work properly. Many more lives would be saved after submersions, suffocations, and electrical shock if the rescuing person would start at once with the Schaefer prone pressure method of artificial respiration. When this has been started it may be supplemented by giving oxygen, preferably mixed with 5 per cent CO_2 by means of a good face mask such as is used in the Haldane or H-H apparatus of Henderson and Haggard. Even the much condemned "Pulmotors" and "Lungmotors" and the like may be of service if they are properly used, but their reputation has suffered from improper usage and publicity.

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DENTAL SUPPLIES AND EQUIPMENT

By H. A. DANIELS, Lieutenant Commander, Dental Corps, United States Navy

The subject of dental supplies and equipment is a vital one to the Navy Dental Corps. Operating efficiency is improved or lowered in accordance with current standards of supply and our ability to recognize to advantage the factors entering into their control.

In presenting certain facts relative to the records and experiences of the Naval Medical Supply Depot at Brooklyn, N. Y., an attempt is made to bring into a more complete understanding the various conditions and complications which confront the dental officer in his pursuit of new and improved materials. It is a well-known fact that changing depot conditions require the occasional adoption of policies which are bewildering in their meaning to requisitioning activities, and to that end, and the correction of all doubtful procedure, this article is directed.

THE ACCOUNTING SYSTEM OF THE MEDICAL DEPARTMENT OF THE NAVY: ITS PRINCIPLES AND OBJECTIVES

No attempt will be made, within the limited space of this article, to set forth the complete details of this system of accounting. Such a maneuver would be both impracticable and beside the point of our discussion. But it is practicable and necessary that we record, as a proper beginning for our paper, a summary of the principles and objectives contained in its composition.

The object of the accounting system is preparedness. It aims directly at the possibilities of supply in national emergency. In a sudden and unforeseen crisis the process of hasty mobilization of the naval forces must essentially concern the depots of supply. If, we may say by way of comparison, many medical and dental activities

have been operating on the basis of reduced supplies and under conditions conducive to unpreparedness, they may be confronted simultaneously by the sudden and imperative demands of war. Requisitions for rapid and abundant issues of supplies will flood the depots; delays will be occasioned in making contact with competent sources of supply; our first line of defense will suffer incomplete attention in view of the concerted demands from naval hospitals and shore stations. Such a condition would tend to minimize the possibility of putting our ships into instant positions of defense under a maximum degree of medical and dental efficiency. It is imperative that these ships be given preference in emergency supply, and for this reason the accounting system is instituted.

This system requires that medical and dental supplies in quantities sufficient to cover all needs for a period of six months be retained on ships and stations, with an additional six months' supply at naval hospitals. This does not mean the retention merely of those items which meet our personal preferences. For example, it may develop that a dental officer entertains derogatory views as to the value of certain materials in permanent restorations. In that belief, he eliminates those items from further requisition and applies their money value to the items of his particular preference in maintaining his six months' or year's reserve. This process of meeting the requirements of the accounting system is wrong. Furthermore, it defeats the exact objectives upon which the system is based. In all probability that dental officer will be replaced, in due course, by one who entertains opposite views in the matter or who prefers to discard in turn, further items as a means of obtaining increased funds for other acquirements. What, then, will be the result? The newly arrived officer will find on his shelves a pronounced shortage of what he may consider material essential for the proper operation of his establishment, and a superabundance of items not to his particular liking. He will, therefore, take immediate steps to correct this situation. This will mean another juggling of supplies that may not be in accord with the views of his relief, and certainly not in accord with the principles of the accounting system. Should various replacements of this character become generally necessary upon the eve of an emergency, little will have been gained by this measure of preparation.

Free of the above transgression, an activity may experience considerable difficulty in maintaining a desired standard of operation under conditions of temporary financial limitation, and, inadvertently or intentionally, draw upon its reserve supplies for upkeep. This practice is a dangerous one. It is not always an easy matter to replace such withdrawals. Improvements and additions catch the eye. We want them. But to realize such possession we must

forego, for the moment, the repletion of our stock. Under this procedure we are likely to find ourselves hopelessly encumbered by factors of additional upkeep and our once proud reserve reduced to the embarrassing reality of a scant two or three months under normal conditions. The way of the transgressor is hard, and sooner or later there must come the "show down." This will be when excess requisitions and a plea for allotment increase reach the bureau. Conditions of stock depletion rarely occur without plausible reason or excuse, and it is always better to acquaint the bureau with early details of such exigencies than to continue the condition to a state of utter incompatibility with the purposes of the accounting system.

It is vitally necessary that all shore establishments place themselves in positions to operate on the basis of self-support for a period consistent with initial depot expansion in cases of emergency, as this period is urgently required to concentrate all issues on the sea forces involved, and to permit the purchasing depot to establish proper contact with the sources of supply in meeting subsequent and greater requests from the service in general. Without this period of immunity there can not be the cooperation necessary to place fighting vessels in an immediate state of medical preparedness. Hence, ALL items of supply table enumeration, regardless of personal preference or prejudice and in uninfluenced relation to temporary conditions of funds, should be carried at all times in amounts sufficient to insure the successful realization of this measure.

MEDICAL SUPPLY DEPOT OPERATIONS

Medical supply depots are established at Brooklyn, N. Y.; Mare Island, Calif.; and at Canacao, P. I. All purchases of medical and dental materials are made by the Brooklyn depot and distributed to the other depots on requisition. The reason for this restriction is apparent. New York is situated in ideal relation to the services of supply and transportation incident to rapid transactions. The vast majority of medical and dental supply houses and manufactories are either situated in New York or retain branch offices in that vicinity. As all materials are purchased with costs of delivery in view, it is considered both economical and convenient that the receiving depot be located as near the majority of the dealers as is possible.

All purchases made—or rather contracted for—at this depot are subject to a prescribed routine of bids and awards, except in cases requiring special action. As the materials acquired in this manner directly affect the dental officer and the quality of his supplies, a brief description of the transaction might prove of interest.

Control of stock.—Dental supplies and equipment are carried on the books of the depot under their respective classes and stock numbers. As issues take place, they are recorded, aside from copy requisitions, in chronological order under these headings, so that a glance will suffice to determine the amount of past issues, to whom issued, and the quantity remaining in stock. Accompanying each item on the books is a red-ink insertion known as the "low-limit" figure. This figure constitutes a very important factor in the control of stock orders. It means that when issues have reached that limit of stock the margin of safety is at a minimum and that repletion must be undertaken at once. This figure corresponds normally to the average yearly issues of supplies over a period of six months. (Here, again, we brush the outposts of the accounting system.) So, when this limit has been reached, such items are filled with the purchasing section of the depot in amounts indicated for order. These orders are governed, of course, by existing depot conditions and the availability of funds in quarterly relation.

Requisitioning for depot supplies.—The next step in the repletion of this stock is the forwarding of a Requisition Form 1 by the purchasing section to the Bureau of Medicine and Surgery for "supplies on shore." After approval of this form by the Bureau of Medicine and Surgery, it is forwarded to the Bureau of Supplies and Accounts for action. That bureau may deem it advisable to issue proposals "on schedule" or forward it in turn to the Navy purchasing office at New York. By "schedule" is meant the local (Washington) handling of the measure in its entirety—the release of proposals, opening of bids, and the awarding of contract. In this instance, all bids and information relative to the purchase are forwarded to the depot for comment and suggestion. If the release of proposals is to be undertaken by the purchasing office at New York, this procedure rests with the latter activity and the depot.

Proposals, bids, and awards.—Upon approval of the requisition, the depot forwards to the purchasing office concerned, stenciled copies of the depot specifications controlling technical and other features of the items required, together with the names of firms on the "bidding list" for material of that character. The bidding list is composed of dealers who have made application for this privilege and who have been satisfactorily investigated as to their business and financial standing. The Navy purchasing office handling these orders may add to the list of bidders such additions as it may elect.

Proposals and specifications are then distributed to the various dealers for bids, the opening date of such bids having been stamped thereon. All interested parties have the right to be present at the opening of bids, which is supervised by the Navy purchasing office

and not the medical supply depot. After the opening of these bids, they are recorded in proper graduation, and forwarded, as soon as practicable, to the supply depot for recommendation of award. Rejection of low bids may be made only when samples and descriptions of the materials sought do not conform to the depot's specifications. Starting with the lowest bid, or the lowest complete bid, samples are inspected and tested in accordance with prescribed measures to determine the materials best suited for use under the reference specifications. While these specifications may be drafted to conform to materials of high quality, it is sometimes difficult to reject "low bid" items which differ from those of exceptional cost only in minor detail. The depot must include with each recommendation furnished, a written explanation of all rejections made under that tabulation. Declaring an item unserviceable for dental use and proving it are two different things. There can not always be covered by water-tight specifications the many conditions of competition, and it is a hard-fought procedure to reject an item which meets generally the requirements of specification and accept its duplicate at increased cost merely because the latter is a product of one of the best-known manufacturers. High cost does not always indicate better material. It usually does, but it can not be assumed as indicating an unerring standard. Some firms are forced to make excessive bids in view of their delivery status and the cost of overhead.

When supplies are rejected, it must be proved conclusively that they can not be used in the particular capacity described in the specifications. This may appear simple of enforcement, but in many cases it is extremely difficult to prove that a certain item, not wholly preferable, does not conform to the specifications, or that it can not be used with equal satisfaction to one of a more expensive origin. In cases where exorbitant cost bridges the gap from an item varying in a negligible degree from the general requirement, to another of the bidding schedule, there presents an excellent opportunity to provoke serious complication and embarrassing redress by rejecting it. It sometimes becomes necessary to give the benefit of doubt to bids generally in accord with specifications which have been drafted to the best of one man's ability, but which lack that one minute detail in a myriad of technicalities required to guard against occasional articles of slight inferiority. In the specifications controlling the purchase of more than 560 items of dental issue, there must be some omission of detail, and some disappointment in quality. No one appreciates this fact more than those concerned in their constant revision and application, and it is often by virtue of such experiences, or through the kindly suggestion of an interested dental officer, that such oversights are brought to light and corrected. For this reason the depot is always pleased to receive criticisms or sug-

gestions relative to its items of supply. The views of many are superior to the views of one, but a general corps cooperation is superior to all.

Issues of dental supplies and equipment.—While the system of stock repletion just outlined appears to offer an unfailing safeguard against the total exhaustion of any item of issue, there are times when even this precaution does not suffice to enable the depot to meet normally all incoming requisitions. We have all experienced, perhaps, the return of a partially completed requisition bearing the green pencil deletion of one or more prominent items, with a notation to the effect that such items had been transferred to a special issue requisition. This means that the items deleted are not in stock at the present time, or in stock in insufficient quantities to meet the request, and that they will be shipped upon stock repletion under a separate requisition prepared by the depot. This in order that the main requisition may be "completed" without unnecessary delay. Requisitions can not be termed "completed" until all items concerned in their make-up have been shipped. Rather than subject the entire requisition to this period of delay, all unavailable items are stricken from the list, and the original requisition allowed to proceed in a completed status. This condition is not uncommon, and is the result of unusual demands made on the supply depots and which can not always be anticipated. For instance, other depots may have excessive calls for supplies in quarters normally quiet, and may find it necessary to make immediate and heavy demands upon the purchasing depot. Coincident with this request, the purchasing depot may also be operating under increased issues for those quarters. Requisitions will arrive at a time when this condition forces the remainder of stock to a state of complete or practical exhaustion before recovery can be made. Why, then, the question might be asked, does not the purchasing depot increase all stock items to withstand any sudden emergency of this character? Why allow standard supply table items to become exhausted in any surprise quarter? The answer is simple. We have already learned that there are some 560 dental items concerned in supply table issues, to say nothing of a formidable nonsupply table stock. As the depot operates on a designated yearly allotment, it follows that certain money values are represented in each item of stock. To concentrate purchases on one or more items above the normal limit of supply is to deprive other items of their necessary funds in the event of stock repletion. Any of these items are subject to unusual call and must, therefore, be allowed to retain their minimum allowances for normal issues and replacements. The fact that an item appears on the supply table is proof enough that it is fast-moving and important. Otherwise it would be eliminated or placed in a nonsupply table status. It is not known where heavy

demands will strike in various quarters, or whether they will strike at all. The only logical form of preparedness in this respect is to maintain a normal stock of all items and to be prepared with funds for their repletion when they reach the low limit of quantity. To increase the stock of all items would be out of all proportion to available funds, as yearly estimates are based on average issues over lengthy periods. It would be poor business indeed to concentrate expenditures on speculation and later discover that the articles selected were not the recipients of that increased and expected attention. There can be nothing more tangible upon which to base our estimates than averages in past records and experiences, and if delays have resulted, perhaps we can derive solace from the thought that it might have been worse under a different arrangement.

When requisitions are received at the depot they are stamped and checked for error in class and stock number enumeration. In cases where an article is not in accord with the stock number given, the depot honors the stock number and not the description. If no transfer or readjustment of items is necessary, the requisition is sent to the dental floor for accomplishment. In this step of depot routine requisitions are examined for notations of preference or for any comment relative to completion and shipment. The items of requisition are then laid out in the order enumerated, triple checked, recorded, and packed. The consignment then goes to the shipping floor for final record and dispatch.

Upon the shipment of stores the **THIRD** copy of the requisition, bearing packing-box number opposite each item, is forwarded, together with bill of lading, to the activity concerned. As soon as practicable after the shipment has been made, the **FIRST**, or original, copy is forwarded in company with the unpriced **SECOND**, bearing the prices of all items of requisition. Upon the receipt of the **FIRST** and **SECOND** copies, the prices are entered upon the **SECOND** and **THIRD** copies, using the **FIRST**, or priced original, for that information. After this has been accomplished, the **SECOND** is forwarded to the Bureau of Medicine and Surgery, and the **FIRST** is returned to the depot filling the requisition. The **FOURTH** constitutes a "working copy" for the depot, and is used for various notations and depot references. This copy remains in the files for general information throughout the transaction. The **FIFTH** copy is retained in like manner by the requisitioning activity as an available reference to the stores requested.

It sometimes occurs that stores are lost in shipment or that a shortage prevails upon unpacking. In this event the depot is notified of the error and correction attempted. If the latter condition prevails, an inventory of the items concerned is made and records compared. If found to be in accord with the depot records it is

presumed that the missing item did actually leave the depot, in which case the requisitioning activity must survey the discrepancy as "lost in transit" and submit another requisition for the replacement. If the statement of the requisitioner is proved correct by the excess on inventory, it is forwarded with no further action.

The above features of supply-depot operation constitute the basis of our subject, and, while incomplete in extensive detail, will perhaps afford suitable stepping-stones of information to the principal paragraphs of our discussion. We have now learned (1) that it is necessary, for the permanent welfare of the corps, to follow in full the requirements of the accounting system; (2) that the purchase of depot supplies is bound by rigid regulations permitting of little variation; and (3) that numerous factors of finance and control prevent the application of measures in conflict with the accepted and enforced standards of supply. This preliminary discussion may or may not have proved instructive, but it may offer to some, who are as yet uninitiated in the mysteries of the unusual, a timely aid to a clear understanding of the explanations to follow. And now we approach the important center of our talk—dental supplies and equipment, and how to obtain them.

SUPPLY-TABLE ITEMS

All supply-depot materials are divided into two main classes, viz, supply table and nonsupply table. The former class we will describe first, as it embodies the principal items of dental issue.

By supply-table materials we mean the officially adopted standards of supply—standards which have become generally recognized as being essential for the modern operation of dental establishments. To comply with the term "essential," an item must be subject to constant use and demand; it must enjoy that prominence of issue that rates it, in purchasing parlance, as a "fast-moving" item. None but fast-moving items, or items essential to proper production, can be placed in a status of routine order and expenditure. A large stock must be maintained under that status, and unless the item will warrant that rapid turnover amongst its fellow items, there is no necessity for tying up unused money values in its retention. As there are other items of like description which would move with greater rapidity and with increased satisfaction, it is proper and just that the former be dropped and the latter instituted as an efficient measure. We have already learned that all items represent certain money values which go to make up yearly allotments on the basis of average previous expenditures, and to permit a slow-moving item to retain a place of prominence in large stock orders is to deprive worthy items of their full and necessary share of funds. Therefore,

when an item is placed on the supply table it is because of its general demand or the belief that it will create that demand through its effectiveness. Should this supposition prove wrong, the item is later removed and replaced by a better one. This process of elimination and replacement rests with the law of demand and supply in relation to changing conditions and continuous improvements in the field of dentistry. Supply-table items constitute the necessary part of dental routine—that is, we could remain in continuous and efficient operation under that source of supply, without the aid of nonsupply-table additions, if compelled to do so. True, our selections and preferences would be somewhat curbed in the process, but we could continue to exist on a normal scale. That is what is meant by the term “supply-table” material. Presently we will combine this class with our next subject for general procedure in requisitioning.

NONSUPPLY-TABLE ITEMS

By nonsupply-table items we mean that class of materials withheld from supply-table listing for various reasons. It may be that an article has not the required prominence of issue to warrant expenditures necessary to maintain it as a standard stock issue; it may be that the item is undergoing tests at designated activities preparatory to placing it on the supply table, or that the material is not subject to routine survey and replacement, as is all supply-table equipment, and can not, therefore, be held subject to general issue, inasmuch as its release rests with the direction of the bureau. It may be that the article has become obsolete, in a general sense, but is still subject to requisition in spite of a more modern replacement on the supply table, or that the item is merely a replaceable part of some supply-table article (such as chair arms, motors and controllers, rubber pads for foot-raising lever of chair, etc.). The reasons for the designation are many and varied. They constitute that great dark and mysterious sea of trouble in which the red pencil of deletion moves freely and relentlessly, and whose successful negotiation depends solely upon the requisitioner's knowledge of his subject.

Nonsupply-table items are given class numbers but not stock numbers. Stock numbers are used only in connection with supply-table material. But all materials, whether supply table or nonsupply table, must be given certain class designations in order that proper records may be kept. The presence of a class number followed by a — (—) indicates that the material mentioned is of the variety contained under that class in the supply table, but that it has no stock number as a result of its nonsupply-table status. In other words, that is the class number under which it would appear if placed on the supply table.

A circular letter containing a list of all nonsupply-table items subject to continuous issue and repletion is issued periodically to all dental officers, but the fact that the enumeration stops there does not mean that the dental officer can go no further in requisitioning. A goodly expenditure represents the annual purchases of exceptional items of requisition—items entirely unassociated with either the supply table or depot stock. Such transactions are known as “special purchases” and are best explained by example.

Suppose a certain activity is in need of a particular type of forceps that is unlisted in any medium of supply. There is a way to obtain this item if it is proved to be a necessary adjunct to the operative efficiency of the activity. The fact that no authorization of its issue is contained in the supply table or in circular letters does not mean that a requisition for it will not be approved. The bureau will decide that issue, and, if deemed advisable, will authorize its special purchase by the depot. In this illustration we are encroaching upon the coming paragraphs of requisitional procedure, but such inclusion is necessary to bring out the point in question. Naval hospitals in particular find it necessary to make occasional requisition for unusual items, and they are furnished in this manner. Special-purchase items are nothing more or less than nonsupply-table items which are unlisted on the books of the depot and which must be specially ordered to complete a requisition. Requisitions for them must go first to the Bureau of Medicine and Surgery for approval. To place the issue in a thoroughly understandable light, it might be stated that the depot will supply you with a horse and buggy if the bureau will approve the requisition. However, under ordinary conditions the bureau considers supply-table items sufficient for general use.

It will be seen, in view of our previous discussion, that the depots are unable to retain in stock every item known to dental manufacture. They can retain only those decreed by popular demand and general necessity. The most popular of these become supply-table items; the less popular ones become nonsupply-table items. Those known only to straggling requisition we term special-purchase items, in view of their special purchase involved in filling requisitions.

With the aid of the list of articles mentioned we can vision, in a general way, just what types of materials go to make up the great division of nonsupply. Instantly we think of scattered items of manufacture—metal parts, laboratory supplies, unfamiliar instruments, and obscure accessories. That is generally correct, but there are some very prominent items of issue in this varied assortment. That this goes against the policy of demand and supply previously described, the reader might suggest. It was mentioned in the beginning of this subject that items sometimes occupy a nonsupply table

status because they are not subject to the prescribed routine of general issue, survey, and replacement. This is one of the exceptions to the rule, and is due usually to excessive cost of equipment, issues being made only by the express permission of the bureau. Consider, for instance, that greatest of all nonsupply table items—the dental operating unit. This item is certainly one of unusual prominence and exceptional demand, but its issues must be necessarily restricted in view of the prohibitive cost of maintenance in addition to the present standard equipment. That this unit will eventually replace the present standard is a likely happening, but it can not now be released in the presence of the many serviceable outfits in use and the large stocks remaining at the medical supply depots. To do this would mean the immediate abandonment of the present standard at a startling figure of purchase replacements and the establishment of a dangerous precedent in the matter of similarly situated nonsupply table equipment. Neither the bureau nor the supply depot is in a position to make such monetary demands, or to explain successfully the necessity for such sudden transition of standards. Unit replacements must be undertaken gradually—either upon original outfitting or in consequence of equipment survey—and with due regard to fiscal limitations. It is something that must come in due course of development and must not be precipitated into headlong confusion and embarrassment. When we pause to consider that dental X-ray equipment, comprising an initial installation value of approximately \$1,000, is also concerned in this type of issue, we realize the possible dangers of such a precedent. This may explain, to the satisfaction of the requisitioning officer, the necessity for withholding certain valuable items from general issue, and the complexity heretofore occasioned by that policy.

We have now acquired a general knowledge of the term “non-supply” and an increased understanding of the policies and conditions governing issues under that class of materials. Let us now increase our field to include all manner of dental items and their accessories. We know that any item unlisted in the supply table comprises a nonsupply-table item as far as our requisitions are concerned. We know that a great many such items are officially listed in nonsupply-table tabulation, and that items retained in neither status are special-purchase items coming under the requisitional requirements of other nonsupply-table items. Then any item of dental manufacture offers the possibility of purchase and issue through one of the three above-mentioned channels. By “possibility” we mean that it would be possible to procure it upon the approval of the requisition. In this respect the requisitioner must rely upon his own judgment as to the probable success of such a request with the bureau. It goes without saying that approval of all requisitions

bearing the titles of innumerable articles culled from dental advertisements will not—can not—be made as a general rule. There must be good and sufficient reasons for making such requests. These reasons must always accompany the requisitions for the full information of the bureau. Prosthetic dental laboratories and naval hospitals probably merit the approval of unusual issues more than any other activities. Their particular field of operation warrants such occasional action as an efficient and expedient measure. The writer has in mind (as a fair example of this description) a recent purchase made for a prosthetic dental laboratory. That activity deemed it necessary for increased efficiency to acquire a high-temperature gas furnace of proprietary manufacture and advertised in one of the dental publications. A nonsupply-table requisition was prepared and forwarded to the Bureau of Medicine and Surgery with a letter of explanation and the magazine cut as a guide to purchase. The requisition was approved, forwarded to the supply depot, and the item delivered within 15 days of the date of requisition. While this transaction would not apply to every conceivable article of manufacture, it will afford a general idea of that phase of nonsupply-table acquisition.

The last, but not least important, division of materials in the class of nonsupply is that of dental accessories. When we speak of accessories we mean those parts of equipment which are vital to normal and efficient operation. Some of these parts are carried as a regular stock of the depot; others, subject only to rare issue, are ordered upon the receipt of requisition in order to avoid tying up their money values in slow-moving stock. The point is, however, that accessories to any item of issue are obtainable upon request, whether officially listed or not. These items can not always be listed in view of certain restrictions, but they can be ordered. This is one phase of nonsupply-table issue that is generally misunderstood and consequently avoided. It is safe to venture the opinion that many dental officers continue to work under certain handicaps because of the lack of complete information on this subject. In order to bring about a clear understanding of the situation we must revert to the term "complete." If those who are concerned in this type of issue will turn to class number 22 of the supply table, they will find that "chair, dental operating, standard," and "engine, dental, electric" are described as being "complete." That means that they are composed of numerous accessories and that such accessories must be present in complete assembly in order to meet the requirement of a supply-table "standard." The fact that such "complete" items of equipment could not be temporarily stripped of an accessory to accommodate a requisition for that item may have perplexed dental personnel in the past. Perhaps they could find no logical solution for the forced delay in sup-

plying the item when it could have been taken from any chair in stock and immediate delivery accomplished. If the correct interpretation of the terms "supply table" and "nonsupply table" has been conveyed in the foregoing remarks, it will be readily understood that the withdrawal of any accessory to supply-table equipment instantly places that equipment in a nonsupply-table status. The absence of a single accessory reduces the "complete" item to a state of incompleteness, and a state of incompleteness has no claim to supply-table listing unless especially designated as a replacement item. Should this stripping of a complete item be undertaken by the depot, that item would necessarily cease to exist in its present status. It would have to be stricken from the supply-table books and taken up on the books of nonsupply in order that its property value and the value of the expended accessory might occasion no financial error upon semiannual inventory. Later, when the accessory was replaced by order, the completed item would have to be returned to its former status at considerable transfer of depot accounting. The detachment of any accessory, for urgent or other cause, is to destroy that completeness of issue which marks supply-table material. There are times when this must be done, but when no great emergency exists it is far more satisfactory to obtain unlisted parts through the prescribed channels of special purchase.

REQUISITIONAL PROCEDURE

PREPARATION OF REQUISITIONS

With the 1926 revision of the supply table of the Medical Department, several changes were made which, it was believed, would simplify the preparation of requisitions for dental supplies. Previous years had witnessed a manifest misunderstanding in regard to accessory items contained in Part 3 of the supply table of 1922. Forms were often at variance with the prescribed policies of requisitioning; general doubt appeared to exist in cases where materials other than that concerned in Form B issues were required; the depot was experiencing an era of requisitional inaccuracy which mounted, in some quarters, to more than 75 per cent of all incoming dental forms. The vast majority of these errors resulted from a failure on the part of the requisitioning activity to list "B" and "non-B" items on separate requisitions. This noticeable increase in incorrectly prepared forms was perhaps due, in a large degree, to increased depot purchases of non-B materials which were placed in nonsupply-table issue upon the release of circular letters to the service. Such items were frequently included among those of Form B enumeration, with the result that much "chopping" and transferring of items was necessary.

In view of this condition, the Bureau of Medicine and Surgery deemed it expedient to incorporate, in the 1926 revision, the major portion of the items previously included in Parts 2 and 3 of the 1922 supply table under one complete listing—such items to be given class designations and stock numbers as a further safeguard against error in both form preparation and supply-depot issue. That this system of requisitioning has minimized the problems of former days is evidenced by the great decrease in incorrectly prepared requisitions now reaching this depot. It is pleasing to note that requests for various items of supply now pass, with little interruption, through the normal routine of business. Thus, a general difficulty has been lessened; we now enter upon a new era, marked with appropriate changes of policies and revised systems of control, and with one more concerted effort it is quite possible that we can entirely eliminate the remaining imperfections in our official procedure.

In the preparation of requisitions for dental supplies and equipment there are a few important facts to remember, and if the dental officer will do this he will have acquired the basic knowledge of procedure. They are:

1. Requisitions must be either supply table or nonsupply table.
2. Items of requisition must constitute either "expendable" or "nonexpendable" issues.
3. "Supplies" are expendable; "equipment" is nonexpendable.
4. Expendable items have "odd" class numbers; nonexpendable items have "even" class numbers.
5. Supply table items are listed in requisition exactly as they appear in the supply table, inclusive of headings, class numbers, and stock numbers.
6. Nonsupply-table items are listed in requisition exactly as they would appear if listed in the supply table, inclusive of headings and class numbers.
7. Requisitions for nonexpendable material should be forwarded via the bureau for survey and replacement information and authorization.
8. Requisitions for expendable material may be forwarded direct to the supply depot—if not in unreasonable excess.
9. Always specify current and voltage when preparing requisition for any electrical equipment.
10. When in doubt, apply for the correct procedure to the supply depot concerned.

With those 10 principles ever present in the mind of the requisitioner, the probability of serious error will be remote.

There are, in addition to this list of principles, the following contributing factors which go to complete the fundamentals of requisition. They are:

Numerical sequence.—When preparing requisitions for supplies and equipment listed in the supply table, items should be copied in numerical sequence to conform to the supply table.

Classes and stock numbers.—Separate items into their respective classes and various classifications under "Headings" as given in the supply table. Enter stock numbers and names of the items on requisition.

Account number.—The accounting numbers for ships and stations are given in the Bureau of Supplies and Accounts Accounting Bulletin No. 1, 1927 edition. If an account number is desired which does not appear in the Accounting Bulletin, it may be obtained from the Naval Medical Supply Depot, Brooklyn, N. Y. This number shall always be entered by the activity submitting the requisition.

Total allotment.—The amount to be entered following these words on a requisition is the annual allotment for medical supply depot supplies and equipment. This amount remains constant.

This requisition.—Following these words should be entered the estimated cost of the items requisitioned. The estimated cost of each item carried in supply-table stock at the medical supply depot will be found in the supply table.

Balance.—The "total allotment" minus the actual cost of all supplies and equipment received from the medical supply depot to date during the current fiscal year, plus the estimated cost of items ordered, will give the amount to be entered as the "balance."

Item.—The items on a requisition should be separated by classes, and the class heading entered as illustrated in the supply table. Example:

SUPPLY TABLE

Dental operating-room equipment Class No. BB (nonexpendable)

22-011 Mat, rubber deck..... one 0 1

or—

NONSUPPLY TABLE

Dental operating-room equipment Class No. BB (nonexpendable)

22—Controller, foot, for Ritter Model "C" dental engine,
110 volts, direct current..... one 0 1

If but one item is requested, there need be no "item number" inserted. If more than one item is requested, they should be numbered in sequence, regardless of changing class numbers and stock numbers.

It will be noted in the above nonsupply-table form that accessory items for supply-table replacements follow the class number of that material.

AN INCORRECT SUPPLY-TABLE REQUISITION

Items have not been separated into their respective classes, and no current and voltage have been given in connection with electrical equipment.

Box No.	Item No.	Stock No.	Item (Use one line for each item. Abbreviate if necessary)	Unit	On hand	Re-quired	Value (To be entered by supply depot)
			DENTAL EQUIPMENT AND SUPPLIES				
	1	13-003	Atomizer, hand.....	one	1	1	
	2	13-005	Atomizer, special.....	one	1	1	
	3	22-005	Engine, dental, electric, all-cord arm with slip-joint connection, complete.....	one	1	1	
	4	23-001	Bag, paper.....	package	1	1	
	5	23-003	Battery, 3-cell.....	one	1	1	
	6	23-005	Bottle, medicine, dental.....	one	1	1	
	7	1-085	Eugenol.....	bottle	1	1	

THE SAME REQUISITION CORRECTLY PREPARED

Box No.	Item No.	Stock No.	Item (Use one line for each item. Abbreviate if necessary)	Unit	On hand	Re-quired	Value (To be entered by supply depot)
			DRUGS				
			<i>Class No. 1 supplies (expendable)</i>				
	1	1-085	Eugenol, 25-c. c. bottle.....	bottle..	1	1	
			HOSPITAL AND NURSING SUPPLIES				
			<i>Class No. 15 supplies (expendable)</i>				
	2	13-003	Atomizer, hand.....	one..	1	1	
	3	13-005	Atomizer, special.....	one..	1	1	
			DENTAL EQUIPMENT AND SUPPLIES—DENTAL OPERATING-ROOM EQUIPMENT				
			<i>Class No. 22 equipment (nonexpendable)</i>				
	4	22-005	Engine, dental, electric; all-cord arm with slip-joint connection complete; 110 volts; direct current.....	one..	1	1	
			DENTAL INSTRUMENTS, APPLIANCES AND ACCESSORIES				
			<i>Class No. 23 supplies (expendable)</i>				
	5	23-001	Bag, paper.....	package..	1	1	
	6	23-003	Battery, 3-cell.....	one..	1	1	
	7	23-005	Bottle, medicines and preparations, dental.....	one..	1	1	

In requisitioning for a nonsupply-table item requiring special purchase, the name of the manufacturer and catalogue or reference number should always be quoted. A cut and full literature should be attached if possible. While the depot is in possession of very complete information as regards the products of various manufacturers, there is always the possibility that the item required may not be included in the files. In such event delay will be occasioned in obtaining proper information or in returning the requisition for further details. In addition to this information, a nonrestrictive purchase notation should be made on the body of the requisition releasing the depot from proprietary procedure. Example:

NONSUPPLY TABLE

DENTAL FRACTURE APPLIANCES AND LABORATORY MATERIAL

Class No. 26 equipment (nonexpendable)

26—Pliers, contouring, Abell type, No. 113, as described in William Dixon catalogue, 1921, Figure 9379, page 69.....One-- 0 1

NOTE.—The catalogue reference quoted in this requisition is descriptive only and not restrictive. It is given as a guide to indicate the type of material required.

Unit.—Enter in the "Unit" column the unit lots of the weight, volume, or number as indicated in the supply table after each item.

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Nonsupply-table items.—Separate requisitions should be prepared for articles listed in the supply table and for those not listed in the supply table. Requisitions for nonsupply-table items should describe such items thoroughly, so that the bureau and the supply depot may readily understand what is desired. The estimated cost of each item must always be shown.

AN INCORRECT NONSUPPLY TABLE REQUISITION

Supply table and nonsupply table items appear on the same requisition.

Nonsupply table

Box No.	Item No.	Stock No.	Item (Use one line for each item. Abbreviate if necessary)	Unit	On hand	Re-quired	Value (to be entered by supply depot)
			DENTAL EQUIPMENT AND SUPPLIES				
			<i>Class No. 22 equipment (nonexpensible)</i>				
	1	22-003	Chair, dental operating, standard.....	one..		1	
	2	22	Unit, dental operating, without engine; 110 volts, direct current.....	one..		1	
			DENTAL INSTRUMENTS, APPLIANCES, AND ACCESSORIES				
			<i>Class No. 24 equipment (nonexpensible)</i>				
	3	24	Hand piece, quadra-angle, Doriot.....	one..		1	
	4	24	Hand piece, straight, Doriot.....	one..		1	

THE SAME REQUISITION CORRECTLY PREPARED

The dental engine necessary to complete this unit installation is an item of supply-table issue. A separate requisition must be prepared for that item, as shown in the correct preparation of supply-table requisition.

Nonsupply table

Box No.	Item No.	Stock No.	Item (Use one line for each item. Abbreviate if necessary)	Unit	On hand	Re-quired	Value (to be entered by supply depot)
			DENTAL EQUIPMENT AND SUPPLIES—DENTAL OPERATING-ROOM EQUIPMENT				
			<i>Class No. 22 equipment (nonexpensible)</i>				
	1	22	Chair, dental operating, standard, without accessories.....	one..		1	
	2	22	Unit, dental operating, without engine; 110 volts, direct current.....	one..		1	
			DENTAL INSTRUMENTS, APPLIANCES, AND ACCESSORIES				
			<i>Class No. 24 equipment (nonexpensible)</i>				
	3	24	Hand piece, quadra-angle, Doriot.....	one..		1	
	4	24	Hand piece, straight, Doriot.....	one..		1	

AN INCORRECT SPECIAL PURCHASE REQUISITION

No general heading has been entered. The information given is inadequate for supply-depot purchase.

Box No.	Item No.	Stock No.	Item (Use one line for each item. Abbreviate if necessary)	Unit	On hand	Re-quired	Value (to be entered by supply depot)
			DENTAL INSTRUMENTS, APPLIANCES, AND ACCESSORIES <i>Class No. 24 equipment (nonexpendable)</i>				
	1	24	Forceps, dental, A. B. Johnson type.....one..		1	1	

THE SAME REQUISITION CORRECTLY PREPARED

Nonsupply table

Box No.	Item No.	Stock No.	Item (Use one line for each item. Abbreviate if necessary)	Unit	On hand	Re-quired	Value (to be entered by supply depot)
			DENTAL INSTRUMENTS, APPLIANCES, AND ACCESSORIES <i>Class No. 24 equipment (nonexpendable)</i>				
	1	24	Forceps, dental, A. B. Johnson type.....one..		1	1	
			This item of requisition conforms to an extraction forceps for lower third molars listed as A. B. Johnson type in H. Fisher & Co. catalogue, Figure No. 6551, on page 38.				
			NOTE.—The catalogue reference quoted in this requisition is descriptive only and not restrictive. It is given as a guide to indicate the type of forceps required.				

The dental officer should be particularly careful in examining his requisitions before submitting them for official action. It is not an unheard-of occurrence that items and stock numbers prove themselves in absolute discord when depot checkage is made. This situation can be officially met by one policy only—that of honoring the stock number and not the item, as before mentioned—in view of the large number of requisitions passing through the depot and the numerical arrangement of stock.

Neatness in preparation is another important factor in correct requisitioning. Neatness in any official undertaking is important, and dental requisitions are not exceptions to the rule. The dental officer who submits well-spaced and beautifully prepared requisitions can usually be relied upon for other forms of official correspondence with equal symmetry and pleasing result, and brevity and completeness of text in all official forms and notations is commendable procedure.

Neatness covers a multitude of sins, and a beautifully prepared requisition and its explanatory accompaniment, even though "requesting the moon," commands utmost respect and earnest consideration because it looks intelligent and shows personal pride and sincerity. While it can not be said that such masterpieces of official correspondence have ever revolutionized the established policies of supply, it can and should be stated that their artists have won, although they may never know it, the whole-hearted esteem and favorable remembrance of reluctant deniers.

SURVEYS AND REPLACEMENTS

Survey of dental material represents an official release from "charge" accountability. By "charge" is meant the nonexpendable status of property. An article that is "on charge" is one whose presence must be accounted for at all times and until removed from that status by an authorized measure.

There are various occasions for property survey, but they all narrow down to one common objective—the release from charge. Many items of dental replacement find origin in this manner, and many factors of control enter into the successful application of survey principles.

Requests for property surveys are prepared and forwarded in quintuplicate on Medicine and Surgery Form Ca. For each item there is entered on this request the item number, quantity, name of the article, date of receipt, purchase price, and a concise statement of the reasons for requesting its survey. If there is no record of cost, an estimated cost must be shown.

Upon the approval of the request, a board of survey is appointed to recommend the disposition of the items concerned. This disposition may be made in any of the following forms:

- (a) To naval medical supply depot.
- (b) To supply department, "for sale" or "for yard scrap heap."
- (c) To destroy, of no value.
- (d) To "retain" or "repair."
- (e) To loss.

When articles are lost or missing, a request for survey must be immediately prepared and forwarded. The members of the survey board will then fix the responsibility for such shortage.

The appraised value of all items must appear on survey. This valuation is fixed by the board but is subject to change by the bureau in accordance with the existing conditions of depot stock and repair. So that an appraised value of \$50 on a returned item does not always mean that amount in actual returned stores credit. This amount may

be lessened or increased (usually lessened) in view of the estimated cost of reconditioning.

Surveys may be held at any time consistent with the necessity for accountability release, but, as a rule, not less frequently than every six months and before the commanding officer of a ship or station is detached.

In requesting property survey, the dental officer must again rely upon his knowledge of the prevailing policies of supply. It is sometimes difficult successfully to navigate the devious channels of replacement procedure. Nonexpendable items can not always be surveyed at the will and pleasure of the progressive requisitioner. Such releases must first be recommended by a board of survey, and good and sufficient reasons advanced in order to secure that recommendation. Few boards of survey are willing to remove from charge new or serviceable equipment without substantial proof as to the efficacy of such a move. It sometimes develops, however, that actual economy over a period of years is afforded by the survey of a current standard and its replacement by more modern and efficient means, the credit derived from such returned stores to be applied to the cost of the replacement. Such cases are not daily recorded in the files of the depot, and one must have a thorough understanding of one's field to carry that maneuver to a successful conclusion. First, there must be sufficient nearness in the cost of the two items to permit of a feasible argument for survey; and secondly, it must be shown conclusively that the replacement sought will prove of increased value proportionate to additional cost. This procedure necessitates considerable correspondence, and its application is usually the result of reduced cost in items of depot stock.

Let us say, for example, that the depot has acquired, free of cost, certain items of dental equipment from a decommissioned Veterans' Bureau activity. We will say that activity has closed with a number of improved articles on hand and it requests their disposition by the Government. Inasmuch as the dental equipment concerned in the operation of any United States activity represents a certain money value derived originally from the United States Treasury, this equipment can not be sold for a mere song so long as some other United States dental activity can use it. After all we are all under one source of expenditure, whether it be this service or that, and to continue such equipment in use prevents the money loss from public sale and, at the same time, retards the necessity for purchasing an equal number of these items in routine stock repletion. Therefore, the services of the United States are circularized and the excess equipment assigned to the dental divisions of such services as have need for it. The shipment is made and we awake some morning to

find our allotted share of these improved articles in our possession. The material has been shipped to the medical supply depot without cost. But we discover that it has been in use for some time and will require thorough reconditioning before any issues can be undertaken. If it can be reconditioned as good as new at cost not exceeding 50 per cent of its original purchase price, such repair is authorized. Here we find an unusual bargain of issue. Here is a golden opportunity to acquire greatly improved equipment for the mere cost of reconditioning. We would like to replace our less efficient equipment with this improved type, but how to do it? It so happens that the cost of repair in this instance will exceed, to some degree, the return stores value of our present standard, even though a request for survey be approved, and the credit thus obtained will not cover the cost of replacement. How will we be able to get around that? How can we acquire this highly efficient bargain in the presence of our still very serviceable equipment now on charge? Only by proving beyond a doubt that the transaction will result in actual economy in proportion to increased efficiency over the normal life periods of both equipments. If this can be done there is a fair chance of obtaining the issue, providing, of course, that the conditions of requisitioning are in accord with the policies of the bureau in the release of such material. The existing policy may be that the material is of insufficient quantity to supply activities other than those actually due for equipment survey and replacement in the normal routine of such matters. It may be that issues have been restricted to certain types of ships or stations, or that issues are to be authorized only in the light of increased output at training stations and the larger activities. There can be no assurance that any attempt to replace serviceable equipment will succeed. That is a matter for official communication and advisement. If our particular case comes within the scope of existing policies, the chance is a good one if we proceed correctly. Otherwise we may fail. We can only base our efforts on increased efficiency and correct procedure and march to victory or defeat well fortified with proof of an eventual economical transaction and improved results.

EXCESS EQUIPMENT IN RELATION TO SURVEY

Another seemingly misunderstood situation in the field of supply is that of excess equipment. It appears to be the desire of many dental officers to acquire or retain on charge operative equipment in excess of dental personnel. Depending upon the type of equipment concerned and the circumstances attendant upon the transaction, this procedure may or may not prove to be of advantage. Many are those who have had occasion to regret that situation following an unsuccessful attempt to obtain new and improved replacements for equipment

actually in use. Current dental equipment does not constitute an unchanging standard. As new and more modern advances are made, they are studied in detail for practicable qualities of standard replacement, and if, as in the case of the dental operating units, they are proved to be of pronounced advantage over the present standard, and within the financial limitations of such standards, they may be adopted as tentative standards and issued as survey replacements. Thus, an activity rejoicing in the success of its former surplus attainments often forfeits its opportunity to acquire improved or unit equipment upon the next survey of outfit by reason of its additional charges. In order to obtain unit or other operating equipment the present outfit must first be removed from charge by survey. If an activity has on charge four complete outfits, two of which are in excess of dental personnel, and consequently little, if ever, used, there will come the time when the two outfits in use will be subject to survey and replacement. The activity will naturally cast a longing eye toward the most modern replacement that the supply depot affords. A requisition will be prepared and forwarded to the bureau for two unit replacements in view of the recent or pending survey. The facts will be looked up and it will be found that there are two additional outfits remaining on charge. The request will, therefore, be disapproved on the very logical assumption that if the two equipments to be replaced are no longer serviceable, there still remain two additional equipments that may be used. This will mean another long period of usage before the request can be repeated.

In spite of this condition, which prevails at several prominent activities at the present time, other activities, operating under normal inventories and conditions conducive to modern replacements, still appear to deem the method of "get all you can" a wise one to follow. In the application of that principle the dental officer is working along the lines of future disappointment, and is more often than not doing himself and his activity a great injustice. It matters not to the medical supply depots how much equipment an activity may obtain on approved requisition, but it does matter to the officer concerned when confronted with the necessity for survey and replacement. He is only "sewing himself up" thoroughly and hopelessly so far as being able to obtain the more modern replacements on future requisition is concerned. This depot has always advised against that procedure whenever possible, not in the light of stinginess but for the future welfare of the activity. A long-established bureau policy directs the issue of dental operative equipment only when it is not in excess of the dental personnel. That is the boomerang that has wrecked the hopes of more than one requisitioner who deemed it advantageous to retain his surplus equipment. Had the matter been

considered from all angles prior to the request for replacement, it is quite likely that all restricting excesses would have been surveyed for return to the supply depot as surplus material. This maneuver would have left him with but the outfit or outfits actually in use to survey and replace, in which event dental operating unit equipment would have been supplied as a matter of established bureau policy.

The logical procedure, then, is to "unload" instead of "load" all nonexpendable equipment subject to constant improvement and change. This does not mean merely dental items of unusual prominence and cost, but nonexpendable items in general. All are subject to change of standard at any time, and the most modern of these may then be obtained upon survey of the old. It is not an advantageous measure to flood any activity with past or current standards of supply because of the desire to secure equipment in excess of immediate dental personnel. It is always best to assure future modernism by removing from charge those items of excess which are merely held as ornaments or "space retainers" rather than necessary equipment. Better, by far, that space or needless equipment be sacrificed to strictly modern installation than to retain such additions at the cost of retrogression. Excess equipment may always be surveyed for return to the medical supply depot as being nonessential for the operation of an activity, and this measure should be resorted to whenever possible as a means of placing the activity in a position to receive the latest depot acquisitions when survey replacements are requested. Should the activity be later augmented by additional dental personnel, or should additional equipment be required for any reason, is it not better to expand with the more recent items of issue than to meet such situations with former and obsolete standards?

For the sake of clarification let us exemplify the imaginary case of Doctor X. That officer is in charge of a prominent dental activity—one, we will say, that was concerned in the rapid expansion of training stations during the late war. During that period eight complete dental equipments were in operation. To-day the average number of dental officers on duty is four. In view of this return to normal, we find that there are four fully equipped dental operating rooms in operation at the present time, and four fully equipped rooms in practical disuse. The four equipments in actual use have undergone long and constant usage and have at last arrived at the destination of survey. Doctor X has learned of the policy to replace such surveys with the improved operating equipment now reposing at the Brooklyn depot. Therefore, he ventures a "feeler" to that depot on the probabilities of unit replacement. In that communication the fact is mentioned that the units are intended to replace the four standard

equipments now pending survey, but no mention is made of the additional equipments remaining on charge. The depot, acting on the supposition that no excess will prevail in view of a complete survey, replies in favorable tenor, stating the existing policy of the bureau in such matters. Survey of but four equipments is then made and a requisition for four unit replacements reaches the bureau. The bureau finds that the recent survey has been approved but that there is no record of a previous survey removing from charge the other four equipments obtained during the war. It then becomes apparent that Doctor X, through failure to mention these additions to the supply depot, is in line for a polite but certain refusal. Quite naturally Doctor X has his private opinion of the supply depot for the embarrassment occasioned, and is many days trying to figure out how it all happened. The fact of the matter is that the depot has mainly the officer's word to act upon, and when a letter is received stating that the article of inquiry is intended for survey replacement, it is but natural to suppose that, in view of that survey, no excess remains. True, there are many files and records to consult in arriving at the true state of affairs, but such information is not always conclusive. Over a long period of years many changes may occur of which the depot is not fully cognizant. Transfers of property may have taken place between neighboring units of that activity, in which event the material shown to be on charge would not have concerned the unit formerly possessing it. It is simply a case of failure to state full particulars, and the depot must abide by the facts as presented by experienced officers.

Now what Doctor X should have done was to present his case in its entirety—describe the material in question and the total number of equipments with which his activity was charged. The depot would then have advised the survey of eight complete outfits prior to a requisition for replacement; four for actual replacement, and four for return to the depot as excess and nonessential equipment. Had this been done, and the transaction followed by a replacement requisition, there would not have been that cause for disapproval.

REQUISITIONING MEDICAL ITEMS

The fact that dental items are often listed under medical classes, both in supply table and nonsupply table enumeration, probably has given rise to some conjecture as to the exact necessity for that situation. We know that certain items contained in the dental class numbers in the supply table are endowed with class and stock numbers far removed from those under which they appear. This constitutes merely the second listing of an item and informs the requisitioner that it is really one of medical supply, but is listed again under a

dental class to assure him that he may obtain it on dental request. An item can not be listed under more than one stock number in the supply table, but it may be inserted in any class desired under that original stock number. Many medical items are directly concerned in the operation of dental establishments. As they can not be listed under both medical and dental stock numbers, they are first listed under their respective classes and stock numbers and then relisted in the dental section of the supply table for information as to their existence and availability.

We further find that some items of strict dental nature are listed only under medical property in both supply table and nonsupply table capacity. By this we refer to dental X-ray supplies and equipment. Why are these items so listed, the requisitioner may sometimes wonder. In arranging supply table or nonsupply table material into official classes, there must necessarily be one class designation for expendable X-ray supplies and one class designation for non-expendable X-ray equipment. When we consider that the greatest money values of X-ray supplies and equipment are carried as medical stock, it becomes clear that such material must be listed under a medical and not a dental class. Under this class there may be included as much dental material as is desired, but its issue must follow the class designation under which it appears. There can not be two class designations for the same type of material. Therefore, we will find in those medical classes certain dental items which we are unable to locate between classes 22 to 27 in the supply table and in the above-mentioned nonsupply table tabulation. This accounts for the absence, from the latter list, of dental X-ray equipment. In order to obtain that item it is necessary to go outside the dental classes and make requisition from the standpoint of medical material. We find that nonexpendable X-ray equipment is listed under class 19 in the supply table, but that no mention is there made of the actual X-ray unit. Therefore, we know that the item sought is carried in depot stock as a nonsupply table article under class 19 (nonexpendable), and that that is why we do not find it listed among dental nonsupply table items.

When in doubt as to the exact status of supplies or equipment, it is a good policy to consult both medical and dental classes in the following order: (a) Classes 22 to 27, supply table; (b) classes 22 to 27, nonsupply table; (c) classes 1 to 19, supply table; (d) classes 1 to 19, nonsupply table. If the article can not then be found, it is not a regular article of supply, and is a matter of depot inquiry and special purchase. If found to exist in any of these classes or divisions, it must be requisitioned under the status in which found.

A CORRECTLY PREPARED REQUISITION FOR DENTAL X-RAY EQUIPMENT

C. D. X. (Coolidge dental X ray) units are listed under Class No. 19, Nonsupply table medical equipment. (See text, chapter Requisitioning Medical Items.)

Nonsupply table

Box No.	Item No.	Stock No.	Item (Use one line for each item. Abbreviate if necessary)	Unit	On hand	Re-quired	Value (To be entered by supply depot)
			X RAY				
			<i>Class No. 19 equipment (nonexpendable)</i>				
	1	19	Dental unit, X ray, bulkhead (C. D. X.) complete, with rotary converter, to operate on 110-120 volts, direct current.....	one	-----	1	
	2	19	Safe, film, dental X ray.....	one	-----	1	

A CORRECTLY PREPARED REQUISITION FOR DENTAL X-RAY ACCESSORIES

The nonsupply and supply table requisitions here shown constitute the complete list of dental X-ray equipment and supplies as prepared by the depot and issued upon original outfitting. In submitting requisitions for C. D. X. units and accessory supplies the exact procedure as given in these two examples should be followed.

Box No.	Item No.	Stock No.	Item (Use one line for each item. Abbreviate if necessary)	Unit	On hand	Re-quired	Value (To be entered by supply depot)
			X-RAY SUPPLIES AND EQUIPMENT				
			<i>Class No. 18 Supplies (expendable)</i>				
	1	18-015	Film mount, dental, 1 1/4 by 1 3/8 inches, 1 fl.....	one	-----	100	
	2	18-017	Film mount, dental, 1 1/4 by 1 3/8 inches, 2 fl.....	one	-----	100	
	3	18-019	Film mount, dental, 1 1/4 by 1 3/8 inches, 3 fl.....	one	-----	100	
	4	18-021	Film mount, dental, 1 1/4 by 1 3/8 inches, 4 fl.....	one	-----	100	
	5	18-023	Film mount, dental, 1 1/4 by 1 3/8 inches, 5 fl.....	one	-----	100	
	6	18-025	Film mount, dental, 1 1/4 by 1 3/8 inches, 10 fl.....	one	-----	100	
	7	18-027	Film mount, dental, 1 1/4 by 1 3/8 inches, 11 fl.....	one	-----	100	
	8	18-029	Film mount, dental, 1 1/4 by 1 3/8 inches, 14 fl.....	one	-----	100	
	9	18-031	Film mount, dental, 1 1/4 by 2 1/4 inches, 1 fl.....	one	-----	25	
	10	18-033	Film mount, dental, 2 1/4 by 3 inches, 1 fl.....	one	-----	25	
	11	18-035	Film X ray, dental, 1 1/4 by 1 3/8 inches.....	dozen	-----	20	
	12	18-037	Film X ray, dental, 1 1/4 by 2 1/4 inches.....	dozen	-----	5	
	13	18-039	Film X ray, dental, 2 1/4 by 3 inches.....	dozen	-----	2	
	14	18-041	Film X ray, 5 by 7 inches.....	dozen	-----	4	
	15	18-067	Holder, ex. dent. X-ray film, wood.....	package	-----	10	
	16	18-083	Lamp, elec. s-14 B 110-volt; 10 watt; frosted.....	one	-----	1	
	17	18-107	Powder developing, 1/2-gallon size.....	one	-----	24	
	18	18-111	Powder fixing bath, 1/2-gallon size.....	one	-----	12	
			X-RAY EQUIPMENT				
			<i>Class No. 19 Equipment (nonexpendable)</i>				
	19	19-005	Cabinet, developing, dental X-ray films, complete, with developing tanks and four 10-clip dental film developing hangers.....	one	-----	1	
	20	19-009	Cassette, metal with double intensifying screens, 5 by 7 inches.....	one	-----	1	
	21	19-027	Hangers, film, developed and dry, 5 by 7 inches.....	one	-----	1	
	22	19-039	Illuminator, magnifying, for dental X-ray films.....	one	-----	1	
	23	19-081	Thermometer, photographic.....	one	-----	1	

"NO-CHARGE" ISSUES

Now that we have, it is hoped, successfully emerged from the labyrinth of nonexpendable procedure, there can be no better chapter with which to conclude our discussion than that of "no-charge" issues. For the benefit of those who may not be familiar with this form of issue, it might be said that the medical supply depots are sometimes in position to supply scattered items and accessories from surveyed material in the form of returned stores. The depots usually retain such items of survey as may be of value in meeting requests for used material, and also in supplying, without cost, and at a considerable saving in time, such items or accessories as may be satisfactorily refinished at the depots or at the requisitioning activity. For instance, if a special-purchase requisition is received at the depot for an accessory replacement for damaged dental illuminator equipment, the needed part may be immediately obtained from a surveyed illuminator, retouched and issued in satisfactory condition, without delay and at no expense to the activity. Such issues usually prove of equal value to newly purchased replacements, and, in view of the expedition involved, are often requested in preference.

This form of procurement can not be relied upon to fill the needs of the requisitioning officer, however, as there is no established routine for the receipt of surveyed materials by the depots. The availability of no-charge articles is a matter for individual inquiry. Requisitions will be accomplished in this manner by the Brooklyn depot whenever such requests and the presence of satisfactory replacements will permit. In applying for this type of issue the requisitioner must take his chances on the desired material being available at the time. For this reason it is advisable to forward with such inquiry a requisition for special purchase authorization in event of the depot's inability to supply.

Little more remains to be said in the light of our discussion. It is realized that many points of interest have been omitted in the foregoing paragraphs, but the writer has endeavored to lay stress only upon those factors consistent with the paramount problems of requisition. It is not at all unlikely, therefore, that several "bug-bears" of our subject will still remain unexplained to some who have ventured to penetrate a little further into the recesses of supply than generally accepted procedure would allow.

EDEMA DISEASE AMONG HAITIAN PRISONERS**THE FACTORS PROBABLY RESPONSIBLE FOR ITS DISAPPEARANCE**

By WILLIAM W. WICKERSHAM, Lieutenant Commander, Medical Corps, United States Navy

In November, 1920 (1), and September, 1924 (2), Mann and other medical officers serving with him in the Haitian gendarmerie, reported the existence of a disease which was characterized by edema and was causing heavy mortality among the inmates of the various prisons of Haiti. This disease was probably a form of malnutrition edema. During a period of 12 months over 1,000 prisoners died from this affection and 375 deaths were reported in a single year in the national penitentiary at Port au Prince where the daily average of prisoners was about 500.

In 1920 a study of the disease was made by the service medicale of the gendarmerie and certain recommendations concerning the sanitation of the prisoners and prisons were made. Since 1923 there has been a total of 29 cases of the disease with 7 deaths reported, distributed over the various years as follows:

	Cases	Deaths
1924-----	12	5
1925-----	14	2
1926-----	1	0
1927-----	2	0

It is evident that some change in the physical condition of the prisoners themselves or in their environment has occurred which has caused the disappearance of the disease. That there has been a gradual improvement in the physical condition of the Haitian citizen there can be no doubt. Through the various hospitals and rural clinics maintained by the Service d'Hygiene syphilis, yaws, chronic malaria, intestinal parasites, and other chronic diseases have been treated and the number of diseased and debilitated Haitians considerably reduced. With the disappearance of banditry and with a general improvement in the economic condition of the country, the peasantry, or common people, have become more prosperous and with prosperity came more food and better living conditions. There are, no doubt, fewer people now of the vagabond class than there were formerly, yet a fair percentage of the prisoners admitted to the prisons to-day are classed as "vagabonds." Vagabonds were usually half-starved individuals who were too old, too weak, or too sick to procure enough food to maintain health and life. These prisoners when admitted are in a physical condition readily to develop edema disease if other necessary factors exist. From statements of gendarmerie officers who have been in contact with the prisons of Haiti for the past 10 years, I believe there is but a slight improvement in the average physical condition of prisoners when admitted. It is safe to reason that changes in the prisoner's environment has been principally responsible for the disappearance of the disease.

The Haitian normally spends most of the daylight hours in the sunlight and open air. The houses or huts of the country people are used chiefly as shelter at night. Until the last four or five years many of the prisoners were confined to their cells for a considerable period of each day, either for disciplinary reasons or because of crowded conditions of the prisons. The Haitian, accustomed to a life of freedom, sunlight, and fresh air, suddenly deprived of these things suffered physically from their loss, and it was noted that the incidence of edema disease was very high among the prisoners so confined. For the past three years, at least, all prisoners except the violently insane or dangerous criminals are released from their cells in the early morning and spend the day in the sunlight, either in the courtyard of the prison or outside the prison as a member of a working party. There has been a decrease in the average number of prisoners, while in most of the prisons there has been an increase in the cell space and in recreation space. The insane, who were formerly cared for in the prisons and among whom there was a high incidence and mortality rate from edema disease, are now quartered in an asylum located in the country about 12 miles from Port au Prince. This institution was formerly a camp for United States marines and provides excellent quarters and grounds from a sanitary point. These patients are kept in the sunlight and air the entire day. At present approximately 99 per cent of prisoners throughout Haiti spend the day in the open air.

Edema disease is probably a food-deficiency disease, and undoubtedly the change in diet as recommended by the gendarmerie medical officers in 1920 was the principal factor in the eradication of the disease.

The articles of diet used in the prisons to-day, with their supposed vitamin content, are shown in the following table:

Food	Grams	Vitamins			
		A	B	C	D
Plantains.....	8.1	—	P	P	—
Vegetables*.....	201.6	P	P	P	—
Fruits *.....	192.0	—	P	P	—
Sweet potatoes.....	201.6	T	P	—	—
Dried beans.....	72.0	—	P	—	—
Rice (polished).....	180.0	—	—	—	—
Corn meal.....	168.0	—	P	—	—
Flour.....	15.0	—	—	—	—
Bread (no lard).....	408.0	—	—	—	—
Beef *.....	98.4	T	—	—	—
Pork *.....	7.5	—	—	—	—
Salt fish (cod).....	15.0	T	—	—	—
Lard (vegetable compound)*.....	21.0	—	T	—	—
Eggs *.....	7.5	P	—	—	P
Coffee.....	6.24	—	—	—	—
Brown sugar.....	34.5	—	—	—	—
Salt.....	18.0	—	—	—	—

P = present, T = trace, — = absent.

The list of articles and amounts were averaged from the ration returns of the national penitentiary at Port au Prince for the first 10 months of 1927. The ration provides about 3,000 calories daily. Corn meal is ground from the whole corn and is not bolted. Only fresh, green fruits are used. No canned vegetables are used. The articles listed as vegetables consisted of cabbage, tomatoes, onions, carrots, water cress (which is served boiled as a green), melaton (a vegetable resembling squash), and alligator pears. Among the fruits are included grapefruit, oranges, limes, bananas, mangoes (which the Haitian eats in great quantities), and green sugar cane. The articles marked * in the table are foods increased or added since 1920.

I have been unable to obtain an accurate list of the articles of food served in the prisons during the years that edema disease was prevalent in Haiti. I have learned from officers of the Gendarmerie who were on duty at the prisons from 1918 to 1925, that there is considerable difference between the menu listed above, as now rationed in the prisons, and the food issued at the time of the epidemic. Plantains, sweet potatoes, rice, corn meal, coffee, brown sugar, and salt have always been issued in sufficient amounts, and at times have composed the entire diet of the prisoners, especially in isolated rural prisons. Fresh fruits, fresh vegetables, fresh beef, pork, salt fish, and lard (usually a vegetable substitute made from cottonseed) were served when obtainable and when the ration allowance permitted, but apparently the amounts issued were small and the issues infrequent. There was considerable improvement in the diet after 1920 and in 1925 orders were issued to include fresh vegetables, fresh fruit, and fresh meat in each day's ration, the meat not to fall below 3 ounces per prisoner. These changes added a number of calories, considerable protein, some carbohydrate, a fair amount of vitamin B, and considerable vitamin C.

The average caloric value of the diet previous to 1925 can not be definitely stated. It was apparently adequate, as there is no reference to general undernourishment or emaciation, other than that occurring among the prisoners afflicted with edema disease, existing at that time. The diet being composed largely of rice, dried beans, corn meal, sugar cane, and fruit, contained sufficient carbohydrate.

It is probable that there was sufficient vitamin B in the dried beans, whole corn meal, plantains, and sweet potatoes to supply necessary requirements, as these articles largely composed the diet and contain a fair amount of vitamin B. There was probably an adequate supply of vitamin C, as fresh fruits and fresh vegetables were issued when available. During the season that mangoes and citrus fruits were not bearing there may have been a deficiency. However, as there is no note of the development of scurvy it is presumed that vitamin C

was sufficient. Vitamin A has not been increased as a result of improvement in the diet and can be excluded as a vitamin deficiency factor. While it is possible that a deficiency of vitamin A or vitamin B may have been an etiological factor, it is believed that they were associated with other factors which were of greater importance.

It is noted from what has been said above, that meats were not issued regularly as a daily part of the ration until 1925. Due to the expense of meat and the difficulty of obtaining it at times there was a tendency to omit it from the diet almost entirely. There seems no doubt that there was a protein deficiency in the diet until 1920. Meat protein was certainly not fed in sufficient quantities and the amount in the corn meal, rice, beans, and plantains was probably inadequate.

During the World War many cases of edema occurred in Europe, reaching epidemic proportions in many places. The condition was believed to be due to a food deficiency of some kind. The symptoms described by observers of the disease resembled very closely the symptoms present in patients suffering from the edema disease. In both conditions edema was the striking feature, while gastrointestinal disturbances, emaciation, muscular weakness, and depression were common to both. Maver (3), as a result of a study of "war dropsy" or "nutritional edema," concludes that it is not due to the deficiency of any one vitamin in the diet, but that there is a low calory diet with low protein content and perhaps a high intake of salt and fluid as the etiological factor. It has been suggested that edema occurs in nephritis and other conditions as a result of low blood protein (4). The blood, due largely to its protein content, has normally a higher osmotic power than the fluid of the tissues. When the blood protein is reduced as a result of excessive protein loss, inadequate protein intake, or some fault in metabolism, there is a fall in the osmotic pressure in the blood which, if sufficient, permits the passage of fluid from the blood to the tissues with resulting edema. This explanation could explain the marked and characteristic edema and the symptoms of malnutrition observed in the edema disease of Haiti.

CONCLUSIONS

1. It is possible that confinement of prisoners in their cells deprived them of the effects of the sun's rays and in this way made them more susceptible to the disease. It seems more probable that prisoners so confined lived almost entirely on the prison fare, largely boiled corn meal and rice, while prisoners not confined had a better opportunity, by smuggling, etc., to secure vegetables, meat, and fruits in addition to the prison ration and so escaped the disease.

2. The incidence of prison edema began to decrease in 1920 following certain changes in the sanitary conditions of the prisons, the most important change being in the diet.

3. There is evidence that there may have been a deficiency of vitamin A, B, or C in the diet prior to 1920 and such a deficiency may have been a contributory factor.

4. There was undoubtedly a shortage of protein, especially meat protein, in the diet prior to 1925 and this deficiency was probably greater before 1920. From the apparent relation of protein deficiency to "war dropsy" and the marked similarity of this disease to the edema disease seen in Haiti, it is the opinion that protein deficiency must be considered as a probable etiological factor.

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COMPRESSED AIR AS A POSSIBLE FACTOR IN THE PREVENTION OF RESPIRATORY DISEASES

By G. H. MANKIN, Lieutenant Commander, Medical Corps, United States Navy

It may be of general medical interest to know that, with one exception, no diver engaged in active diving on the wreck of the U. S. S. *S-4* from December 18, 1927, to March 16, 1928, was incapacitated for duty or prevented from taking his regular turn by reason of general illness or injury.

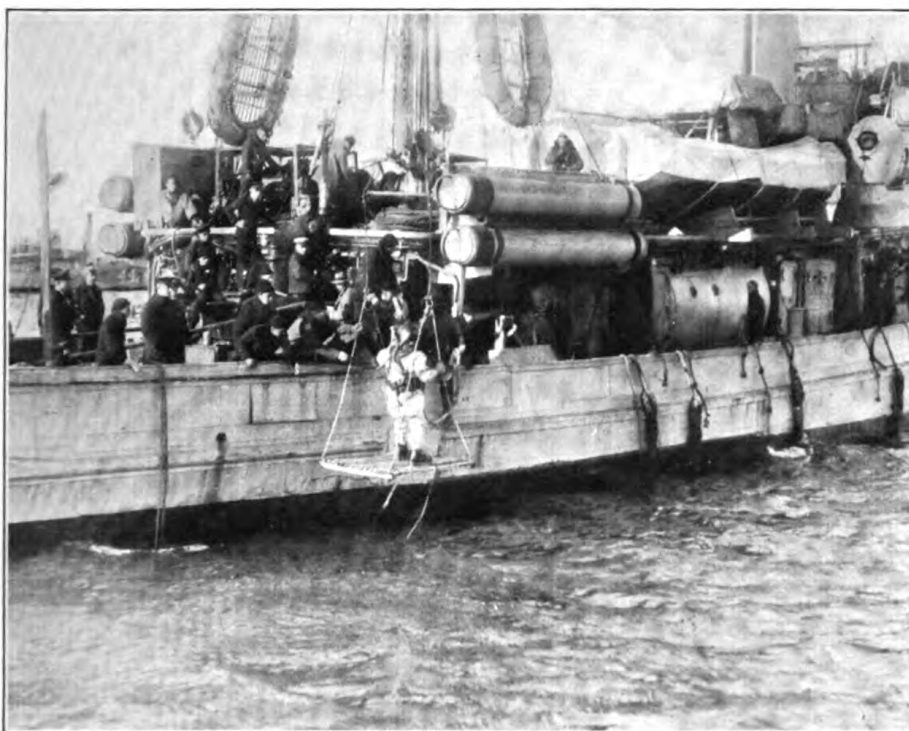
Chief Torpedoman F. G. Michaels, United States Navy, provided that exception. During impossible diving weather on the day following the collision, *i. e.*, December 18, 1927, when no diver would have been asked to descend to the wreck except as a life-saving measure, Michaels went down through the ice, storm tossed waters to connect an air line to the submarine. Before he could accomplish this, he was dragged from the deck of the *S-4* by the yawing of the rescue ship in the heavy seas and high winds, and fell over the side into the mud which gripped the submarine, then his life line and air hose became fouled in the wreckage. In addition, the air line which he had taken down to connect to the *S-4* became entangled in the torn and cut steel and lay across his body. He was now lying on the deck of the *S-4* with the air lines and hose securely holding him down and preventing his escape. He could not clear himself but did not wish to ask another diver to come to his assistance. To have pulled on his

air hose would have been to risk cutting it on the sharp, jagged steel wreckage. After he had been down two hours and it was apparent that he could not clear himself, he signalled to the surface through his telephone and asked aid. Chief Gunner's Mate Thomas Eadie, United States Navy, who had already made his dive for the day, the first one made on the *S-4*, was sent to the rescue. Michaels suit was cut and he was wet, cold and practically exhausted. Eadie worked for nearly two hours with a hack saw before he could clear him from the wreckage. Finally Michaels, after almost four hours' imprisonment, came to the surface—unconscious. His suit had to be cut away from him and he, quite stiff from cold and exposure, was with difficulty gotten into the recompression chamber where restoratives and external heat were applied while he was undergoing decompression. He suffered from no respiratory affection as a result of his experience and was ready to resume diving after about three weeks with no permanent disability. He could have returned to duty sooner but for a perforated ear drum sustained, no doubt, when he fell from the deck of the submarine into the mud. Such a fall would entail a sudden increase in pressure of about 10 pounds. The ear drum healed with only a minor scar and he had no difficulty in taking pressure during the remainder of the salvage operations.

It is a rather significant fact that during the active diving operations no diver suffered from any of the respiratory affections to an extent that prevented him from taking his regular daily dive. It is well known to those associated with deep-sea diving that even a mild coryza will usually tend to prevent a diver from readily taking the pressure incident to his descent into the water. He has difficulty in equalizing the pressure on his ear drums, due, no doubt, to congestion of the Eustachian tubes. The descent of each diver to the wreck was carefully watched with this in mind. In the 566 dives made during the salvage work not more than 6 showed any slowness in going down through the water. These divers were given an examination following the dive, in the hope of locating the cause for the slow descent. Divers, as a rule, pride themselves upon the rapidity with which they slide down the descending line. In the cases examined, there were found certain of the following conditions: Hypertrophied tonsils, sclerosed and retracted ear drums, or intranasal pathology, any one of which could have been a causative factor in slow equalization of pressure on the ear drums.

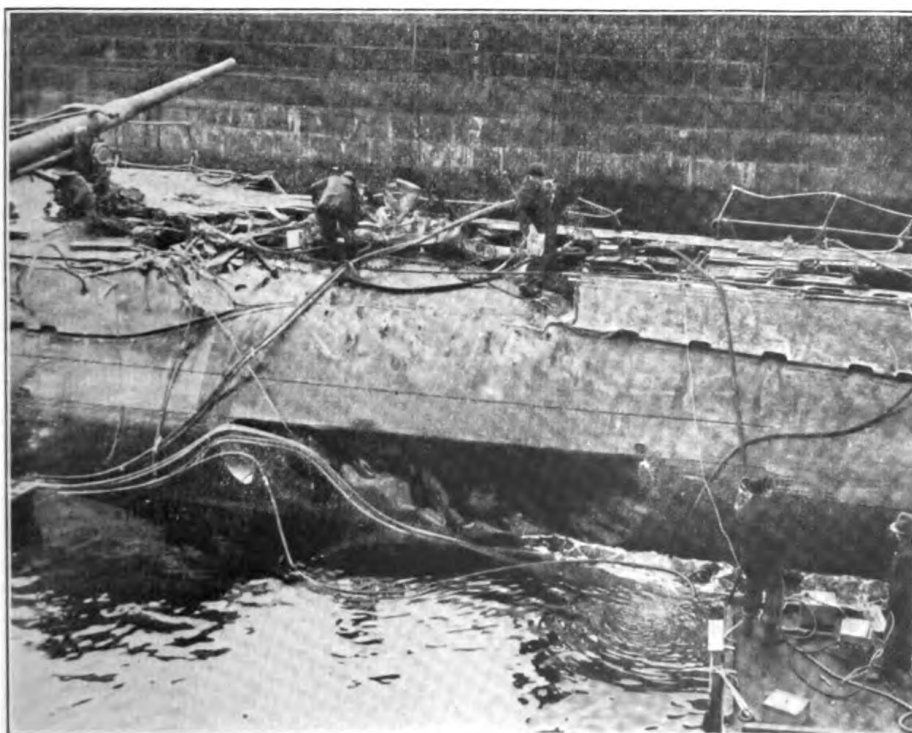
The personnel of the salvage ship, the U. S. S. *Falcon*, other than divers, suffered from a normal or perhaps increased incidence of respiratory diseases, such as acute rhinitis, acute catarrhal fever, and acute bronchitis. There were two cases of broncho-pneumonia.

The average complement of the *Falcon* under ordinary circumstances is 60 officers and men. During the salvage operations this



International Newsreel Photograph

FIG. 1.—A DIVER BEING LOWERED INTO THE WATER FROM THE STARBOARD SIDE OF THE "FALCON." ONE DIVER IS ALREADY ON THE WRECK. THE RECOMPRESSION CHAMBER IS SEEN FARTHER FORWARD



International Newsreel Photograph

FIG. 2.—THE "S-4" IN DRY DOCK AT THE U. S. NAVY YARD, BOSTON, AFTER BEING RAISED AND TOWED FROM PROVINCETOWN, MASS. THE HOLE IN THE BATTERY ROOM AND OTHER DAMAGE SUSTAINED BY COLLISION WITH THE "PAULDING" CAN BE PLAINLY SEEN

was increased by 40. In addition, there were 50 men who were employed and subsisted on board during diving hours but quartered on other vessels of the salvage fleet. The above figures include the 25 divers. All but two or three of the regular divers were quartered on the *Falcon*.

From the above it will be seen that there was necessarily some overcrowding of compartments, a potent factor in the spread of respiratory diseases. The divers were not billeted in one compartment by themselves, but were distributed throughout the ship and were, at times, in close contact with those suffering from minor respiratory disorders.

All of the members of the salvage force were exposed to rather severe weather conditions. The winter and spring months off the tip of Cape Cod are characterized by high winds and seas, associated with low temperature and high relative humidity.

Divers were exposed to a rather wide variation in temperatures, pressures, and humidities by reason of their employment. When a diver was brought from the bottom directly to the deck of the *Falcon* as was done during the colder months, quick work was required to get him into the recompression chamber and under pressure in order to avoid the development of compressed air illness, or caisson disease. His helmet, weighted belt, and shoes were removed as quickly as possible and he was in the chamber inside of two minutes. While the pressure was being run up to an appropriate amount for the depth and length of his dive, his breast plate and suit were removed. He was then given 30 cubic centimeters of ethyl alcohol in hot coffee. Warm, dry clothing was provided for those divers who were wet as a result of their dive, either through a cut and leaking suit or as a result of a leaky exhaust valve. It sometimes occurs that a diver will get wet through an exhaust valve that functions perfectly. In talking over the telephone it is necessary for him to close off his air supply to hear conversation. Under these conditions the pressure in the suit may not be sufficient to prevent a certain amount of water entering through the exhaust valve.

Under pressure in the chamber the air becomes warm and the diver's body reacts to the increased temperature. When the pressure is lowered, as it is in stage decompression, he becomes cold and requires additional clothing. On being released from the chamber the divers had to walk along an exposed deck to reach the living quarters which were crowded and warm.

With regard to the pressure of compressed air required by the divers at the various depths in connection with the salvage of the U. S. S. *S-4*, it may be mentioned that when on the deck of the submarine the divers were subjected to a sea pressure of 39 pounds; when

on the bottom alongside the *S-4*, to a pressure of 46 pounds above that of the atmosphere; and when tunneling beneath the mid-section of the submarine to place pontoon chains, to a pressure of 59 pounds above atmospheric pressure. The pressure maintained inside the suit is usually a pound or two above that of the sea in order to prevent water coming in through the exhaust valve as well as to keep the suit inflated and away from the diver's body. The air was supplied by steam-driven air compressors to the diving lines at 150 pounds pressure and reduced at the diver's hand-operated control valve to the pressure required for the particular depth.

To illustrate the method of decompression, the decompression for use when a diver has been at 102 feet for 1 hour is given below. The diver on being brought directly from the bottom is placed in the recompression chamber and under pressure of 25 pounds for 4 minutes; 20 pounds for 16 minutes; 15 pounds for 13 minutes; 10 pounds for 20 minutes; 5 pounds for 30 minutes; then out of the chamber to atmospheric pressure, a total decompression time of 73 minutes. Shorter or longer submerged periods at that depth require appropriate decompression tables.

From the above it will be seen that while the pressures involved are not extreme, they represent a distinct variation from that in which we normally live.

The general physical make-up and observable condition of the divers were essentially the same as those of the other members of the crew. They slept in the same compartments and the overcrowding must have affected both equally. The food served and the clothing issued were identical as to amount and quality. When the divers were not specifically employed, they were usually about the exposed decks helping wherever they could. The items in which they differed from the other members of the crew were, in brief, as follows:

(a) They were under compressed air in connection with the diving and decompression.

(b) They were given alcohol after dive.

(c) They were perhaps more carefully watched for physical deterioration.

(d) They were given one week's leave out of every three toward the end of the salvage work; the others were granted four days' leave in each calendar month.

(e) The average age was slightly higher than that of nondiving members of the crew.

One is not warranted in saying that the breathing of compressed air was responsible for the freedom of the diving personnel from respiratory disturbances. The data cover too few cases, and other factors involved must be given consideration. Still, the facts are

suggestive and indicate the need of investigation into the possible benefits of increased air pressures in the prevention of respiratory diseases.

DENGUE

A STUDY BASED ON 100 CASES

By J. E. MILLER, Lieutenant Commander, Medical Corps, United States Navy

Dengue is an acute infectious disease and probably a bacteremia. It is, like all infectious diseases, self-limited in duration and cured by the development of immune bodies in the blood of the infected patient.

The course of dengue is very strikingly five days. That is, from the time of the development of fever until the subsidence of the fever, or the period in which the patient suffers from the manifestations of the disease. This 5-day course of the disease is so characteristic that, in practically 100 per cent of cases, the date of termination of the disease can be foretold.

The causative microorganism of dengue has not been isolated nor demonstrated from the blood of patients suffering from the infection, but it does undoubtedly exist in the blood of such patients, because if the blood from such patients is injected into a susceptible individual the latter develops all the manifestations characteristic of dengue after an incubation period of from 3 to 7 days. The organism must be very small, for it readily passes through a fine filter, and the filtrate thus obtained is still infectious.

There appears to be only one explanation as to why the microorganism of dengue has never been discovered, and that is its smallness and the failure of our present-day microscope to magnify this ultra-microscopic organism to a degree that is sufficient to bring it within our range of vision.

The etiology of dengue is so well understood at the present date, that is, as to the manner of transmission of the disease, that little need be said upon this point. All authorities recognize that the mosquito is the active transmitting agent of the disease and that in the Philippine Islands, the *Aedes* is the mosquito concerned. They know that the mosquito becomes infected from the sucking of the blood of an individual sick with dengue; that after a period of 10 to 12 days—incubation period—this mosquito is capable of transmitting the disease to a susceptible person. After a period of three to seven days the individual bitten contracts the infection and can now transmit the disease to the mosquito. It is this continuous circle of mosquito to human inoculation and human to mosquito inoculation that keeps dengue prevalent in the tropical and subtropical countries

where climatic and geographical conditions are favorable for the multiplication of the mosquito.

Consequently, dengue is present either in endemic, epidemic, or pandemic form throughout the year—both during the rainy and dry season—and such localities are never free from the disease.

Dengue is found principally throughout a geographical area from latitude north 32 to latitude south 23. It is found in Southern China, Indo-China, India, Philippine Islands, Spain, Central and South America, and the southern part of the United States. Dengue may appear outside of its natural habitat, and has at times occurred as far north as New York, Philadelphia, and Boston. When it occurs outside of its natural locations dengue occurs during the warm season of the year, because this season is necessary for the life and multiplication of the mosquito in these places. Dengue is carried to these localities by human carriers that infect the mosquito population. Later, the infected mosquito infects other individuals of the community, until the disease becomes widespread through this process.

From an epidemiological standpoint, it can be seen that the widespread distribution of dengue in the tropical and subtropical countries presents an enormous problem. From its mode of transportation through human and mosquito carriers from place to place; from the favorable conditions for mosquito breeding and life; from the lack of funds to fight or bring about the destruction of the mosquito in these countries, due to the lack of economic and industrial development; from the lack of interest taken by the inhabitants of these countries in the fight against mosquitoes and the destruction of their breeding places; and, lastly, from man's inability, both physical and financial, to overcome nature and convert subtropical and tropical countries into those with a moderate and temperate climate, it may be seen that the prevention of dengue and malaria will be no easy matter.

Dengue travels just as fast as man can travel. I have seen patients inoculated with dengue in southern China—Hong Kong and Canton—develop the disease upon arrival in Manila, at a distance of some 600 miles. The time used in traveling between these places served as the incubation period. There is no doubt that Hong Kong furnishes the Philippine Islands with a number of active carriers each year and that the Philippine Islands furnish Hong Kong a number of carriers in return. There is no doubt that Indo-China and India furnish South China with a number of active carriers; likewise, in return, South China furnishes these locations with a number of cases.

While much work is being done in the Philippine Islands in regard to the eradication of mosquitoes and the prevention of malaria and dengue, it must not be forgotten that, no matter how efficient and well organized are the organizations carrying on this type of work,

they will never be able to obliterate the breeding places of mosquitoes in rice-growing countries, for the paddy fields, carabao wallows, and lowland are necessary for the agricultural development of the country. So long as such places exist mosquitoes will breed and multiply and in these areas will always be plentiful enough to keep malaria and dengue present.

The Rockefeller Foundation is active in the Philippine Islands and is doing much to prevent malaria. However, when the above factors are considered, it appears that this organization is bound to fail in the complete destruction of mosquito life. There is very little malaria in Manila and the large cities in the islands, as malaria is a rural and not a city disease. Dengue, however, is a city disease and is found to be prevalent in nearly all cities in the Philippine Islands.

Another organization that is doing good work is the "Mosquito Control Committee," which was organized under the direction of Acting Governor General Gilmore. Governor Gilmore worked on and was instrumental in having introduced and passed by the Philippine Legislature a bill called "Filling in the lowland in and about the city of Manila." The filling in of the lowlands is an efficient and the only permanent method of destroying mosquitoes in and about the city of Manila, and in time will be the biggest factor in the prevention of dengue in this location. The bill authorizes the floating of bonds for 1,000,000 pesos that are to be sold to the people of the city, and the money thus gained is to be spent on the filling in of lowland where water collects and stagnates. Up to this time the bonds have not appeared on the market, none have been sold, and the filling in of the lowland has not been started.

In addition to securing the passage of this vital bill the Acting Governor General appointed a committee for the control of mosquito breeding in and about Manila. The committee is a large one made up of about 40 members who are representatives of the Rockefeller Foundation, United States Army, United States Public Health Service, Philippine Health Service, and the United States Navy, and superintendents of schools, the chief of police, and newspapermen in and about the city of Manila.

So far there has only been one meeting of this general committee, that being the original meeting held in the fall of 1927. At this time many recommendations were made in regard to the steps to be taken in the control of mosquito breeding. Active propaganda was started to inform the public of the necessity of destroying mosquitoes. The superintendent of schools prepared information for the children of school age, who became active in picking up and doing away with empty tin cans and bottles which served as mosquito breeding places. The police were active in reporting insanitary conditions found

about the city. The health department instructed its representatives to call from house to house in search of breeding places for mosquitoes, such as water dishes used beneath table legs, bed legs, and ice-box legs to keep ants away. Housewives were instructed to empty these frequently and to place oil in them. They were also instructed to empty flower vases at frequent intervals. Blocked gutters were given attention. Ponds and water holes were oiled. But, in spite of all this work, dengue continues to be an active agent in causing many thousands of sick days during the year among the inhabitants of Manila.

Of all steps taken, the filling in of lowland is the big step in the right direction. As about 90 per cent of the city of Manila, according to information given by the members of the committee who are qualified to make such a statement, requires filling in, since that much of the city is under water during some time during the rainy season, 1,000,000 pesos will probably only start the work, but, once started, this good work may gather momentum as it progresses, and finally the lowland in and about Manila may be completely filled in.

As to malaria in the city of Manila, I have never seen a case develop in any member of the naval personnel living in Manila which could be shown to have originated there. There has been some malaria among naval dependents visiting the Provinces where malaria is prevalent. However, such is not the case with dengue. Dengue is frequent among members of the families of the enlisted men and officers residing in Manila. The prevalence of dengue in naval dependents is highest among new arrivals from the United States. The majority of these people are susceptible to the disease and most of them suffer from it during their first few months of residence in Manila. When nearly all have suffered from dengue the prevalence of the disease drops, only to return to its high level with the coming of new members of the families of naval officers and enlisted men.

Dengue hits the foreigner hard. Nearly all are susceptible who have never lived in the Tropics before. History shows that, among those who have lived in the Tropics at previous times and have suffered from the disease, many will not acquire dengue during their second stay in the Tropics; the reason being that they possess enough immunity from former attacks to protect them. Not all patients affected with dengue call a doctor, especially if the attack is mild, and such cases are seldom recorded. A severe attack of dengue appears to immunize the patient against further attacks for a period of from one to one and a half years, although some may and do have the disease three or four times during a cruise of two and one-half years in the Tropics and appear never to acquire an active immunity. Some members of the family will not acquire the disease, while others living under the same hygienic and sanitary regulations will.

Most individuals try to avoid being bitten by mosquitoes in the hope of escaping the disease. In the Tropics much mosquito punk is used for this purpose, and many yards of mosquito netting are employed. Neither method is markedly effective. Histories of dengue patients reveal the fact that practically all of them sleep during the afternoon rest period and at night under mosquito netting, and that during the time not spent under these perforated tents mosquito punk is kept burning. The *Aedes* is sure to find an opportunity to bite a person when he is away from his mosquito netting and smoking punk. The mosquito is under the table in the home and in the hotels, and it is here that he gets his chance. Perhaps, if all the money spent for oiling bodies of water, cleaning streets, netting, punk, and the like could be donated yearly to a fund for filling in lowland and for public-health instruction of housewives, much could be done to prevent dengue and do away with mosquito life. Nets, of course, are a great benefit in that they keep away flies, insects, biting ants, and the like. But mosquito netting cuts off practically all circulating breeze and makes people uncomfortable during the hot season. If a person is suffering from dengue and has a high fever, life under mosquito netting is almost unbearable. The patients usually throw nets aside after the doctor's visits, to get what cool breeze the tropics have to offer. This is the time when such patients should remain under netting, as they are active carriers of dengue.

The incubation period of dengue in the mosquito is said to be 10 to 12 days, while in the human it is stated that this period runs from 3 to 12 days, usually about 7.

The pathology of dengue is little understood, because people suffering from the disease never die in uncomplicated cases but recover after a period of five days or so. Early in the case the blood will show a marked diminution in the number of polynuclear cells. There is usually a slight increase in the lymphocytes, either relative or actual, which may result from stimulation of the lymphatic tissue with a liberation of new cells into the general circulation, as it is characteristic to find lymphatic enlargement or adenopathy in about 75 per cent of dengue patients. The glands most often affected are the postauricular, cervical, axillary, and inguinal glands, while, very often, the epitrocheal glands are also involved. The superficial glands may not be affected in dengue and in these cases there is undoubtedly involvement of the deeper glands which is not recognized. Glandular involvement should be sought for in all cases, and, if carefully looked for, will be found more frequently than is now the case. The enlargement may be but slight—the size of cherry-seeds—or the glands may be as large as walnuts. Such enlargements are often painful to the patient even while he is at rest in bed and often

cause pain in the axilla and groin. Pressure upon these enlarged glands elicits tenderness. They rapidly subside after the disappearance of the fever.

No study of the spinal fluid of dengue fever cases has been undertaken to my knowledge, but, in a disease that causes such headache and lumbar backache, there must be some meningeal congestion to account for these severe symptoms. Again, in a disease that shows changes in sensation of the hands and feet, in which these parts ache, feel swollen, and are often numb, there must be some temporary disturbance in the nervous system. It is likely that photophobia met with in this disease is a result of nervous irritability of the retina or optic nerve. Severe and sharp shooting pain occurs in dengue. It is often knife-like in character and comes on much like the lightning pains of myelitis or tabes. The pain passes down the arm and into the hand or down the leg and into the feet; sometimes it darts through the chest or abdomen and often causes much apprehension to patients experiencing it. There appears to be only one way to account for these symptoms and that is that there must be either a nonsuppurative meningeal involvement or a general toxic condition of the nervous system with more or less involvement of the peripheral nerves as well. While it is not necessary to study the spinal fluid in all dengue cases, a study of the fluid from a few cases would be of value, if made during the course of the infection. In severe cases with high fever traces of albumin are present in the urine, this albumin rapidly disappearing with the subsidence of the fever. It is probably the result of cloudy swelling of the kidneys, which is found associated, more or less with all diseases running a course of fever. The rash of dengue is darker than the rash of scarlet fever and lighter than the rash of measles, although it is more like the latter in being macular instead of punctate. It is followed by a bran-like desquamation. It occurs on the hands, feet, arms, legs, chest, abdomen, and face and neck in well-marked cases. It appears about the fourth day of fever, and, after the fever subsides, fades in a day to three days. During the time of the rash there is tingling, numbness, and a sensation of creeping insects under the skin. These sensations are slight in some cases, but very marked in others.

The above-subjective symptoms are common in dengue. Otherwise the symptomatology of the disease will depend much upon the virulence of the infecting organisms and the degree of resistance that the patient has to offer against this invading agent. Consequently, the signs and symptoms of dengue will vary and will resemble those of other infectious diseases.

As there are ambulatory cases of typhoid fever, influenza, and the like, so there are such cases of dengue to be seen. Patients suffering from the ambulatory form can not state at just what time they began

to develop the disease; they, however, do know that they feel offshade and unwell. There is likely to be a half degree or a degree of fever present which causes muscular and joint pain, with more or less soreness of the eyes when they are moved about. After four or five days of mild suffering, during which time the patient may never go to bed or may continue with his work, he suddenly discovers a rash more or less pronounced. This rash usually worries the patient and he seeks advice from his physician. If he has no rash and has not been ill enough to call a doctor his disease usually goes unrecognized; he is glad enough to be well again, and lets the matter drop, while all the time he has not even imagined that he has been an active dengue fever patient. Even in these cases it is not hard to find some glandular involvement if it be looked for. Children are liable to have this type of infection, for children suffer from the symptoms of dengue lightly and seldom complain even when the fever is about 102° F. They are up and about, paying little or no attention to the disease if the fever is not high enough to cause vomiting, convulsions, and delirium.

However, in a moderate or severe case of dengue, the disease usually sets in acutely and the patient is willing to go to bed of his own accord and to remain there until the fever is over. He may feel offshade physically for a few days before the onset of active symptoms. In these cases, at the time of onset the patient may experience chilliness or actual chills may occur.

Chills and chilliness come and go in dengue fever. This is more characteristic of dengue fever than of any other infection except septicemia. However, the chills of dengue occur every hour or so throughout the course of the infection, while the chills of septicemia occur usually during early or late afternoon. There is fever in dengue throughout the course of the disease, except for a few hours during the second day of the attack, when the fever may disappear, only to return in a few hours with an aggravation of all symptoms. The sensations of fever and chilliness alternate practically throughout the course of a severe case of dengue. After the development of chilliness or chills and the development of fever the patient is nauseated and often vomits.

The onset of dengue in children may be severe, with chills. Sometimes a general convulsion will be seen, and there will surely be more or less anorexia with spells of vomiting. Vomiting may last only a day, may last two days, or throughout the course of the disease. However, after the first day or so this gastrointestinal disturbance usually subsides and the children pay little attention to the rest of the fever period and seldom complain or give reliable histories as to the subjective symptoms experienced.

The temperature in mild cases is usually under 100° , with a pulse of about 90. Moderate cases run a temperature of about 103° , with a pulse of 100, while severe cases may run a fever as high as 105° to 106° , with a pulse rate of 120. Irregularity of the pulse has been noted in cases with high fever, this disappearing with the rest of the symptoms after the subsidence of the fever. In many cases the "camel back" type of fever is not seen and the temperature remains above normal for about five days. On the last day the temperature reaches its highest, at which time the rash of dengue appears in about 75 per cent of cases.

During the course of the disease and when the fever is highest there will be pain in the eyeballs, even at rest, but most when the eyes are moved. There will be tenderness of the eyeballs if pressure is made on them. There are headache and backache both in severe cases, being as distressing as those found in smallpox. There is a generalized soreness of the muscles and joints, none of which are swollen or tender on pressure. In addition, there will be sharp, shooting pain down the arms and legs, and in women often in the pelvis, back, abdomen, and chest. If women with dengue have just finished menstruating they are apt to start again and to menstruate severely. If they are near their time of menstruation the onset of this appears early. After dengue, menstruation may be irregular and amenorrhea or metrorrhagia may be experienced for a few months. Women who have suffered a severe attack of dengue usually have a general falling of the hair, which is replaced with new hair in two or three months. Dengue fever does not cause miscarriage, nor has the disease complicated pregnancy or future delivery in any way. However, women appear to suffer more than men from the symptoms of dengue, and even in mild cases are apt to complain a great deal.

Dengue fever patients frequently sleep poorly and sleep is often broken by dreams. There may be sore throat in dengue without objective signs. This is probably the result of some nervous change, which is responsible also for tingling, numbness, and the sensation of creeping insects under the skin.

The duration of dengue is so characteristic that over 90 per cent of the patients treated—100 cases—were told exactly the date on which the disease would terminate. This fixed duration of the disease should be used in making a differential diagnosis in patients who fail to develop a definite rash or in those who do not develop a definite adenopathy.

Ordinarily, the diagnosis of dengue is not difficult. In a patient with fever; chillness; muscular and joint pain, without objective signs in the muscles or joints; headache and backache, with soreness

of the eyeballs; and a fever of five days' duration, dengue should be thought of, and, if signs and symptoms of all other infectious diseases are absent and the patient is living in a dengue region, the diagnosis is practically made, even if the adenopathy and rash are missing from the clinical picture.

Dengue should only be diagnosed by the exclusion of all other infectious diseases. Leukopenia is said to aid in diagnosis, but it must be remembered that leukopenia is found in so many conditions that its occurrence is of less importance than was formerly thought. It occurs in influenza, a disease which resembles dengue, and its presence offers no aid in differentiating these diseases. However, a blood count is indicated in all fever patients and if a leukocytosis is found it speaks against the presence of dengue. In children, especially girls, the urine should be examined for pus, for pyelitis may cause a fever that may be mistaken for dengue. Blood smears should rule out malaria. Dengue rash is sometimes mistaken for the rash of measles, but the history of coryza, the presence of Koplik's spots, and the catarrhal cold are not met with in dengue. It is true that dengue fever patients often have a catarrhal inflammation of the upper respiratory tract which precedes the development of dengue, but in these cases Koplik's spots will always be absent, and the history will reveal the presence of a cold that may have lasted for weeks or months.

The complications of dengue are few. There is more or less prostration and exhaustion following a severe case. This may last for weeks. Usually within from four to seven days the patients feel well and are back at work. There may be a continued headache for a few days, likewise neuralgia, anorexia, and the irregularities of the menses in female cases. Children have practically no complications and are back on their feet in a day or so, even in severe cases.

The treatment of dengue will depend upon the severity of the symptoms of the infection; some cases requiring no treatment, while other patients with severe infection will require almost constant care.

All dengue fever patients should be given a cathartic at the beginning of the infection, and all should have a daily bowel movement throughout the course of the disease. Purgation should not be used during the latter days of the fever, for the patients are often so weak that fainting may occur as a result of it. A mild laxative or a soap-suds enema is to be preferred.

In fever cases there should be an abundant supply of cool fresh water at all times and the patient should be encouraged or even forced to drink copiously. Water is the most important drug we have in fever cases, as it dilutes the toxins of fever and hastens elimination through the urine, feces, and sweat. Water also assists

the bowels in daily action. If the fever is high and the patient is in delirium it is surprising to see how rapidly the temperature will fall if such a patient be given three or four quarts of water per day. The fluid intake may be increased by giving water-ices, iced lemonade, orange-ade, tomato juice, fruit juice, or grape-juice.

There is no objection to frequent cool sponging of the body during dengue. Such a procedure should be carried out to make the patient more comfortable and for hygienic reasons, but little lowering of the body temperature in dengue from cold sponging should be expected.

The diet in dengue will not worry the patient or the doctor. Mild cases can eat whatever they like; moderate and severe cases suffer from anorexia and vomiting and will not desire food. If they eat they will usually vomit the food taken in a few hours. However, the liquids mentioned above are indicated and usually agree with the sickest of dengue fever patients.

In severe cases something must be done for the severe backache, headache, and general restlessness met with. Mild and moderate cases can usually get along with a capsule of salol, aspirin, and phenacetin, but in severe cases I have found no drug that will give the patient more comfort and the doctor more satisfaction than the administration of $\frac{1}{4}$ to $\frac{1}{2}$ grain of codein every eight hours. Codein may be given alone or with the capsule spoken of above. It is likely to add to the constipation already present in dengue and, if it be used, laxative medication should be given daily.

The treatment of 100 cases of dengue occurring among naval dependents was carried out in the homes or rooms of these patients. All cases recovered. Delirious patients should be hospitalized but, due to the fact that dengue fever cases are not taken into the Sternberg General Hospital, such patients in Manila have to be treated in their homes, as the cost of hospitalization in that city in civilian hospitals is prohibitive.

CLINICAL NOTES

REPORT OF MALARIA AND MICROFILARIA SURVEY OF 11,000 LABORERS AND 2,007 CHILDREN IN HAITI¹

By P. W. WILSON, Lieutenant Commander, Medical Corps, United States Navy

It was the writer's good fortune again to be present as observer for the Service d'Hygiene of the medical activities of the emigration bureau, Port de Paix, November 30, 1927, to January 30, 1928. Dr. H. C. Clark, of New York, was in charge of all physical examinations, vaccination, and medical activities among the emigrants. His assistants, for varying periods of time, were Doctors Cordes and Malorette and Mr. Hutchens, technician, of Preston, Cuba; Doctors De la Torre and Meny, of Banis, Cuba; Doctor Feitus, of Zurich, Switzerland; and Doctor Newmann, of Aux Cayes; and it is due to the hard work and cheerful cooperation of these men working under trying conditions that this report is possible.

It will not be out of place at this point to describe the routine through which every laborer has to pass who desires to ship from Port de Paix for the Cuban cane fields. He, with a group of 11 others, undresses, and is examined by a doctor as to his general physical condition, age, presence of ulcers, hernia, heart disease, or any physical defect that would be a handicap to him in his work. (Most of the rejections were for youth or old age.) When the examining doctor is satisfied as to his physical fitness the man is seated on a low bench, his body bent well forward, elbows resting on his knees, and the doctor, sitting behind or to the right side of the man, palpates for the spleen with the right hand, using the left hand as counterpressure behind. (This method of palpating the spleen has every advantage in speed over the classical method. It was found that if the palpation were made just as soon as the man's body was bent well forward, the abdominal muscles were thoroughly relaxed and one could feel easily well up behind the rib margin.) The palpable spleens were recorded as "just palpable," or "plus 1, 2, 3, or 4 fingers" below the costal margin. The man next goes to another doctor who washes his ear and takes blood for hemoglobin estimation, and a thick drop preparation is made for malaria and filaria search. At this time the man is given a numbered brass

¹ Read before the Second Congress of Medicine in Haiti, May 2, 1928.

check; his hemoglobin is read and recorded opposite his name and check number; the same check number is recorded on his blood slide. He is vaccinated with cowpox vaccine and then takes 1 cubic centimeter of oil of chenopodium together with 60 cubic centimeters of a saturated solution of magnesium sulphate. From the doctors he goes to the registration official who records his name, home address, and check number. He is photographed with the 11 others behind him who are passing through the same routine, and his picture with the registration data will be placed on his passport.

The hemoglobins were done entirely with the Talquist scale. Fifty readings were checked against the Sahli hemoglobinometer at different times, and the slight variations in the readings of the two instruments were of no consequence. The blood slides were examined by two or three doctors and one technician, all trained in thick-drop examination. Because of the large amount of work it was necessary to limit search for malaria to 50 fields. All slides were examined under the low power for filaria. Each evening a list was made of the positive malaria slides, and the following day these men were sorted out when they came for their ration pay, and they were given 1 gram of quinine each. The quinine was swallowed in the presence of a doctor. All positives who reported for ration pay were given 1 gram quinine daily until they had taken seven doses, or they could continue on with the treatment if they wished. Quinine was also given to all who asked for it, and there was always a large number of volunteers. There is no doubt but that this wholesale administration of quinine among 11,000 men drawn from all parts of Haiti will have a far reaching educational effect in favor of the benefits derived from this drug, and of course the same holds true for the oil of chenopodium. Many men, with no intention of going to Cuba, came to the emigration office to ask for a dose of the "worm medicine." It is rather remarkable that of the 11,000 men who received chenopodium there was only one who suffered any ill effect. He had been walking for two days with almost nothing to eat, and shortly after taking his oil he became ill with nausea, gastric distress, and feeble, rapid pulse. His condition cleared as the purgation was completed.

An attempt was made to treat with plasmochin compound all men who had more than one crescent to every five microscope fields. As none of these men were ill it was difficult to persuade them to come to the dispensary for treatment, in spite of the fact that they were given a double ration pay for so doing. The routine treatment was as follows: Four pills of plasmochin compound daily—two in the morning and two in the afternoon, each pill containing 1 centigram of plasmochin and 125 milligrams of quinine. In the seven cases

treated crescents and ring forms disappeared from the blood smear as follows:

	Pills
Check No. 885, after 4 days.....	16
Check No. 1182, after 6 days.....	18
Check No. 1688, after 5 days.....	16
Check No. 2450, after 6 days.....	20
Check No. 4946, after 4 days.....	16
Check No. 6727, after 3 days.....	12
Check No. 10039, after 5 days.....	18

In the case of one man, Check No. 2450, there was undoubtedly plasmochin poisoning. The facts in his case were as follows: The man was registered December 7, and blood smear showed crescents, one in every four fields, hemoglobin 60 per cent. Treatment begun December 11, when ring forms, one to every five fields, and one crescent in every three fields were found. December 14, three crescents found after long search. December 15, one crescent found after long search. On the morning of December 17, the patient, a man of about 45, of good physique and previous good health, came to the dispensary and complained of gastric pain and dizziness since the evening before. He had vomited once. He was pale and slightly jaundiced. Blood smear showed a marked basophilia of the red cells, strong polymorphonuclear leucocytosis estimated to be between 20,000 and 25,000, hemoglobin 45 per cent, and one crescent found. Plasmochin discontinued. Total plasmochin given—20 pills. Patient was sent to the hospital with a diagnosis of plasmochin poisoning. December 18, patient felt weak, blood smear was negative for malaria parasites; marked basophilia, leucocytosis strong, hemoglobin 35 per cent. December 21, improved, blood smear was negative for parasites, basophilia present, slight leucocytosis, but the hemoglobin had risen to 60 per cent. Discharged, well.

Toward the end of the emigration season it was decided that the value of the findings among such a large number of adults would be considerably enhanced if similar work could be done on groups of children in each of the sanitary districts of Haiti. The survey of the children was done by Doctors Clark and Feitus together with the writer, and a more complete study was done in the Hinche district, for which Doctor Hill was largely responsible. Thanks to the work done by the public health officers in all districts in sending in blood smears with spleen and hemoglobin estimations, it is possible to give the results on 2,007 children under 14 years of age. The following tables are self explanatory:

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TABLE No. 1.—*Summary of malarial parasite with spleen index, laborers and children, by districts*

Sanitary district	Percent- age laborers, positive malaria	Percent- age children, positive malaria	Percent- age spleens palpable, laborers	Percent- age spleens palpable, children
Port de Paix:				
Number of laborers examined, 5,927	24.6		3.6	
Number of children examined, 424		50.2		23.3
Cap-Haitien:				
Number of laborers examined, 2,303	20.8		2.3	
Number of children examined, 173		24.8		10.4
Gonaïves:				
Number of laborers examined, 1,977	23.6		1.9	
Number of children examined, 149		9.4		8.08
Port au Prince:				
Number of laborers examined, 251	18.3		2.3	
Number of children examined, 179		49.16		18.4
Jacmel:				
Number of laborers examined, 224	28.5		5.9	
Number of children examined, 100		74.0		3.0
St. Marc:				
Number of laborers examined, 119	22.2		2.6	
Number of children examined, 130		39.2		31.5
Petit Goave:				
Number of laborers examined, 106	19.9		1.8	
Number of children examined, 103		58.2		46.1
Aux Cayes:				
Number of laborers examined, 39	25.6		7.6	
Number of children examined, 100		66.0		23.0
Jeremie:				
Number of laborers examined, 37	13.5		8.1	
Number of children examined, 100		67.0		32.0
Hinche:				
Number of laborers examined, 19	36.8		0	
Number of children examined, 549		61.9		22.4
Total laborers examined, 11,000	23.5		3.03	
Total children examined, 2,007		50.52		21.57

TABLE No. 2.—*Species of parasites found*

	Laborers		Children	
	Number	Per cent	Number	Per cent
Estivo autumnal	2,231	86.3	874	86.19
Quartan	336	12.9	123	11.23
Estivo autumnal and quartan	9		12	1.18
Benign tertian and quartan	1	.38		
Benign tertian	8	.34	5	.49
Crescent carriers	198	8.87	98	11.2

TABLE No. 3.—*Summary of intensity of infection found in positive blood smears*

	Laborers		Children	
	Number	Per cent	Number	Per cent
Smears showing more than one parasite to every five fields	653	22.2	242	23.8
Smears showing from three parasites in entire search to one in five fields	878	34	338	33.3
Smears showing one or two parasites to entire search	1,054	40.9	434	42.8

TABLE NO. 4.—*Summary of hemoglobin estimations*

	Laborers		Children	
	Number	Per cent	Number	Per cent
Hemoglobin, less than 60 per cent.....	236	2.3	141	7.4
60 to 70 per cent, inclusive.....	9,514	86.4	1,142	59.8
Above 70 per cent.....	1,248	11.3	624	32.8
	11,000		1,907	

NOTE.—Hemoglobin estimations were not done on 100 children, Aux Cayes.

TABLE NO. 5.—*Summary of spleen findings*

	Laborers	Children
Spleens:		
Just palpable.....	263	212
Plus 1 finger.....	47	142
Plus 2 fingers.....	18	59
Plus 3 fingers.....	5	17
Plus 4 fingers.....	1	3
Total	334	433
Per cent	3.03	21.57

Laborers: 224 of the palpable spleens were associated with negative blood smears, or 67 per cent; 110 of the palpable spleens were associated with positive blood smears, or 33 per cent.

Children: 294 of the palpable spleens were associated with negative blood smears, or 67.9 per cent; 139 of the palpable spleens were associated with positive blood smears, or 33.1 per cent.

Species of malarial parasites found associated were:

	Laborers	Children
Estivoautumnal	92	231
Quartan	18	53
Benign tertian		2
Mixed infections		8

TABLE NO. 6.—*Summary of microfilaria findings, by districts*

District	Number of laborers examined	Percentage positive for filaria	Number of children examined	Percentage positive for filaria
Cap-Hatien.....	2,303	5.0	173	1.74
Port-de-Paix.....	5,927	.7	424	.94
Gonaïves.....	1,977	.3	149	.00
Port-au-Prince.....	261	4.7	179	1.67
Petit-Goave.....	106	5.6	103	.00
St. Marc.....	117	4.2	130	.00
Jacmel.....	224	.9	100	.00
Aux Cayes.....	39	.0	100	.00
Hinche.....	19	.0	549	.00
Jeremie.....	37	.0	100	2.00

List of locations where filaria have been found: Acul du Nord, Port Margot, Le Borgne, Cap-Hatien, Limbe, Limonade, Quartier Morin, Le Trou, Grande Rivière du Nord, Caracol, Ste. Suzanne, St. Louis du Nord, Anse à Foleur, Jean Rabel, Port-de-Paix, Mole St. Nicolas, Bombardopolis, Baie de Henne, Gonaïves, Ennery, Gros Morne, Arcahaie, Léogane, Port-au-Prince, La Gonave, Petit-Goave, Baradères, Anse à Veau, Miragoane, St. Marc, Jacmel, Trouin, Corail.

Last year among 6,400 laborers the percentage of those positive for malaria was higher, namely—26 per cent as compared with 23.5 per cent this year. This is accounted for by the fact that this year the microscopic examination was limited to 50 fields, while during the previous survey the search was considerably longer—approximately 75 fields. The differences in the estivoautumnal, 80 per cent, and quartan, 19 per cent, incidence last year as compared with 86.3 per cent and 12.9 per cent this year is probably due to the same factor in a measure, also to difference of personnel doing the microscopic work. When it is realized that the above figures are the result of but a single examination of not more than one and a half minutes of a thick film preparation it is evident that only a part of those carrying malaria parasites are found. If the number of palpable spleens not associated with positive blood smears be added to the positive parasite cases, the percentage is increased in the laborers from 23.5 per cent to 25.3 per cent, and in the children from 50.5 per cent to 65.1 per cent.

The hemoglobin findings are interesting, and it should be added that in only three adults was a reading as high as 80 per cent obtained; in children readings of 80 and 85 per cent were not uncommon. It is impossible to estimate accurately the relative importance of malaria, hookworm, malnutrition, and yaws as factors in the cause of anemia in this country. But it is believed that malaria is by far the greatest factor.

It is apparent that the spleen index is of but little value in estimating the prevalence of malaria in Haiti. This may be accounted for in the high racial tolerance or the high incidence of estivo-autumnal infection as compared with quartan and benign tertian. It did appear, however, that in most localities giving a high spleen index among children there was also found a larger number of blood smears showing heavy infections.

CONCLUSION

We are all familiar with the almost hopeless task of mosquito control in the rural districts. Even with unlimited funds and personnel such a control would be impracticable for many years to come. The one method of attack which remains to ameliorate the present condition is a widespread educational propaganda in the use of quinine, and to put quinine within easy reach of every person in Haiti. In order to show how inaccessible quinine is to the average countryman the accompanying table of prices demanded for quinine is of interest. (See table). In many communities (the writer made personal inquiry at Thomassique, Cerca La Source and Saut d'Eau), quinine is unobtainable at any price, except on the days when the

rural clinics are open when it is given free to those who come. Five years ago when quinine cost about twice as much as at present the pharmacists' prices in Jacmel were practically the same as those charged today. It is evident they estimate their selling prices on what the traffic will bear rather than on a basis of a reasonable profit based on cost. One pharmacist explained to me that the profit on quinine, which does not depreciate with age, covers the losses on those drugs which do. It would be interesting to know what he charges for his unstable drugs. These figures speak for themselves and the writer refrains from further comment except to state that it is his opinion that no druggist, or doctor who receives a commission on his prescriptions from a druggist, has the moral or legal right to oppose making quinine a government monopoly, and giving it at cost price or free to the people.

TABLE NO. 7.—Table of prices demanded for quinine sulfate, 26 pharmacies, with estimates of the percentage profit

Location	Quantity ordered in grams, per capsule	Quantity delivered in grams, per capsule	Selling price in gold per capsule	Estimated cost price (gold) per capsule in Port au Prince	Estimated percentage profit if full weight delivered	Estimated percentage profit on actual weight delivered	Remarks
Port-au-Prince:							
Pharmacy A.....	0.50	0.377	\$0.06	\$0.0107	460	646	
Pharmacy B.....	.50	.257	.06	.0107	460	985	
Pharmacy C.....	.50	.42	.05	.0107	357	456	
Pharmacy D.....	.50	.405	.05	.0107	357	476	
Pharmacy E.....	.50	.164	.06	.0007	460	1,113	
Pharmacy F.....	.50	.50	.04	.022	82	82	In tablet form.
Jacmel:							
Pharmacy G.....	.50	.469	.06	.0107	460	497	
Pharmacy H.....	.50	.495	.08	.0107	648	662	
Pharmacy I.....	.50	.233	.06	.0107	460	1,102	
Pharmacy J.....	.50	.373	.06	.0107	460	651	
Cayes:							
Pharmacy K.....	.50	.30	.10	.0107	834	1,457	
Pharmacy L.....	.50	.31	.10	.0107	834	1,406	
Cap:							
Pharmacy M.....	.50	.206	.05	.0107	357	1,036	
Pharmacy N.....	.50	.297	.041	.0107	283	544	
St. Marc:							
Pharmacy O.....	.50	.688	.08	.0107	647	443	
Pharmacy P.....	.50	.46	.08	.0107	647	712	
Pharmacy Q.....	.50	.47	.05	.0107	357	396	
Pharmacy R.....	.50	.25	.05	.0107	357	836	
P. de Paix: Pharmacy S.....	.50	.39	.06	.0107	460	619	
Pt. Goave:							
Pharmacy T.....	.50	.399	.06	.0107	460	601	
Pharmacy U.....	.50	.550	.08	.0107	647	579	
Gonaïves:							
Pharmacy V.....	.50	.462	.08	.0107	647	708	
Pharmacy W.....	.50	.150	.10	.0107	834	3,015	
Pharmacy X.....	.50	.450	.08	.0107	647	729	
Jeremie:							
Pharmacy Y.....	.50	.423	.07	.0107	554	672	
Pharmacy Z.....	.50	.297	.10	.0107	834	1,472	
Jean Rabel, dealer.....	.50	(¹)	.20	.0107	1,169	1,769	

¹ Not weighed.

The average percentage profit on actual amount delivered, if the Jean Rabel dealer gave full weight, is 876 per cent. The quinine was not tested for adulteration except by taste and appearance.

AN OUTBREAK OF CEREBROSPINAL FEVER IN NORTHERN HAITI¹

By O. WILDMAN, Lieutenant Commander, Medical Corps, United States Navy

Lying to the south of the coastal plain of northern Haiti is a rugged area of considerable extent accessible only by difficult mountain trails. Due to the difficulties of communication with the more enlightened coastal regions, the people of this section retain many of the superstitions and customs of former years. Although they have learned the value of consulting the modern doctor for the diseases with which they are familiar, the occurrence among them of a virulent unknown disease, especially if accompanied by delirium, appeals to their sense of the supernatural and the expulsion of the embodied evil is better left to the secret incantations of the "bocor" than to modern medicine. For this reason a considerable epidemic might occur in the neighbor of a well-attended clinic without a case of the mysterious disease presenting itself to the visiting doctor.

In the latter part of February a rumor of an unusual number of deaths occurring in the district of Dondon reached the Service d'Hygiene at Cape Haitien. The public health officer immediately made an investigation in the town of Dondon and held a special clinic, which was well attended. Only the usual increase in prevalence of malaria following the rainy season was noted. On March 8 a report of an unknown disease of great virulence was received from Cerca-la-Source. As this commune is not in the district of Cape Haitien the report was forwarded to the director general. About the middle of March reports reached the Cape that a strange malady was occurring at Grande-Riviere with fatal results after an illness of 12 to 24 hours. A Service d'Hygiene officer had held a clinic there a few days previously with an attendance of over 300 and had seen no signs of an epidemic, nor had the Service d'Hygiene doctor located at Grande-Riviere reported unusual health conditions. On the 17th of March the public health officer proceeded to Grande-Riviere to investigate. No cases could be found in the town, but it was reported that some sick people had been removed to the country. The gendarmerie officer was then asked to detain in their houses any cases that occurred. The next day, March 18, the visit to Grande-Riviere was repeated and the first case was discovered in an old man, who had all the signs and symptoms of cerebrospinal fever. He refused, however, to be moved to the hospital at Cape Haitien nor would he permit a spinal puncture to be made. The house was cleared of neighbors and quarantine of the house established by the aid of the gendarmerie. The next day I was able to obtain a spinal puncture on a typical case and to bring him and another case to the hospital.

¹ Read before the Second Congress of Medicine in Haiti, May 2, 1928.

From March 19 to March 26 eight cases were transferred to the Justinien Hospital. Seven from Grande-Riviere and one from the Cape, the latter a bread-seller on the street, who had a very virulent infection and died within 12 hours after entering the hospital.

After March 26 the epidemic became quiescent and it was not until April 13 that a gendarme from Milot was admitted. A week later the epidemic was raging in the mountainous region south of Acul du Nord. During the next 10 days this region furnished the majority of cases seen during the epidemic. A few cases were admitted during this time from Plaine du Nord, Sainte-Suzanne and Le Trou.

In all 77 cases were treated, 35 males and 42 females. All age groups up to 70 years were represented, the majority, however, were under 30 years. Mortality was highest in those past middle life.

In the temperate zone epidemic meningitis shows a seasonal prevalence for the colder six months of the year and is usually associated with overcrowding and depressing physical conditions. It has been observed many times that carriers clear up promptly with the coming of warm, bright days, such as are always prevalent in Haiti. It is strange to note, therefore, the fact, as stated by such well-known authorities as Osler and Rosenau, that epidemics in temperate climates are localized and are rarely widespread, while only in the Tropics have there been extensive killing pandemics.

It is generally recognized by authorities that the spread of an epidemic of cerebrospinal fever is not materially influenced by any of the preventive measures that may be logically undertaken. Our aim in this epidemic was to search out and obtain prompt transfer of cases to the hospital for isolation and treatment, and by closing the schools, prohibiting unnecessary gatherings, such as cockfights, dances, etc., to limit intimate contact as much as possible. These measures were admirably carried out under the personal supervision of the director general assisted by three additional medical officers of the Service d'Hygiene, the medical personnel of the gendarmerie and Marine Corps, the police force of the gendarmerie and the priests of the various towns. By means of handbills wide publicity was given in regard to areas affected, number of cases, symptoms, preventive measures, and necessity of hospital treatment.

In discussing the symptomatology of the cases seen in this epidemic mention must first be made of a painful stiffness of the muscles of the back of the neck as an early and important symptom. The muscles of the back and legs were likewise stiff and painful and orthotonus in the more severe cases made lumbar puncture difficult. Sensitiveness along the spine was marked in the majority of cases. Vomiting was not a feature except in a few cases. Headache was severe and persistent. Delirium was a marked feature in severe cases.

The temperature was variable and was not always an indication of the virulence of the infection. The majority of the cases showed temperature ranging from 100 to 103, but one fatal case ran a temperature around 99. A noticeable feature was a slow, full pulse. Herpes occurred in four cases, but petechial rashes, if present, were not visible on the dark skins. Pneumonia was a complication in four cases with two deaths. Arthritis was noted in three cases and iritis and conjunctivitis in four. Special diagnostic features of importance were a positive Kernig, which was present in all but eight cases, and lumbar puncture with the withdrawal of a turbid spinal fluid.

The spinal fluid was not under increased pressure, except in a few instances. In some of these, however, the increase was marked. Cell counts ranged from 160 to 9,000 per cubic millimeter, the average being about 6,000. The predominating cell was the polymorphonuclear leucocyte. Smears from the centrifuged spinal fluid showed the typical Gram-negative diplococci in 29 cases. The organisms were found both free in the spinal fluid and intracellular. A reliable incubator was not available so culturing was not attempted. Blood agar slants were inoculated, however, and taken to Port au Prince by the pathologist of Haitian General Hospital. It was discovered that tubes of spinal fluid that were negative by smear often gave heavy growth of meningococci when left at room temperature for 24 to 30 hours. White blood counts varied between normal and 60,000, averaging about 16,000 with a moderate increase in polymorphonuclears, usually 75 to 80 per cent.

Intraspinal injections of antimeningococcus serum were given in 15 cubic centimeter doses at 24-hour intervals. As the supply of serum available was limited during most of the epidemic, dosage had to be regulated in accordance with urgent needs. Serum was given intravenously in some of the cases seen early to combat the bacteremia. Simple withdrawal of spinal fluid was found to be of value in itself. Eight cases were of a mild type and recovered without the administration of serum. Of the 77 cases seen in the epidemic, 12 died, a mortality of 15.5 per cent.

TUBERCULOSIS IN HAITI¹

By M. E. HIGGINS, Commander, Medical Corps, United States Navy

The strength of the gendarmerie d'Haiti in 1927 was 2,518 men. The total number of deaths from all causes was 25—an annual death rate of 9.9 per thousand. Pulmonary tuberculosis caused 11 of these deaths, making an annual rate for this disease of 4.36 per thousand.

¹ Read before the Second Congress of Medicine in Haiti, May 2, 1928.

In other words, 45 per cent of all the deaths in the gendarmerie were due to tuberculosis.

The necropsy records of the Haitian General Hospital indicate that approximately one-third of all the deaths at that institution result from tuberculous infection. It is obvious that tuberculosis is a leading cause of adult death in Haiti and constitutes a health problem equaled in importance only by treponematosi and malaria.

The following comparative admission rates and death rates for tuberculosis are of interest:

Admission rates

United States Army, 1923:	Per 1,000
White troops in the United States.....	2.6
White troops in Philippines.....	17.15
Colored troops in the United States.....	3.6
Philippine troops.....	28.78
United States Navy, 1921-1926.....	3.22
Gendarmerie d'Haiti, 1927.....	8.3

Death rates

Gendarmerie d'Haiti, 1927.....	4.36
City of Panama, 1925.....	3.67
City of Colon, 1925.....	2.01
United States (41 States), 1926.....	.87

While the numbers involved in the statistics for the gendarmerie are small they furnish some indication of the prevalence of tuberculosis among the civilian population. It is reasonable to suppose that the death rate for the general populace is equal to if not greater than that observed in the gendarmerie, since the gendarme is better housed, has better food, and lives under more hygienic conditions than men of his class in civilian life.

In England and the United States there has been for many years a progressive reduction in the death rate for tuberculosis, so that the disease is no longer the leading cause of death. Its place has been taken by diseases of the heart. The chief factors in this reduction have been:

(1) A general improvement in the cultural status of the masses which has given them better houses, better food, and better conditions of hygiene.

(2) An intensive educational movement having as its aim the dissemination of knowledge relative to the disease—its cause, mode of transmission, and methods of combating it.

(3) Segregation of the disease in special hospitals and sanatoria so that opportunities for its spread are curtailed.

(4) The establishment of special clinics for the early diagnosis of the disease.

In the prevention, control, and treatment of tuberculosis in Haiti all of the above factors will have to be considered. Improvement in the social condition of a nation is, of necessity, a gradual process, but it is manifest that such improvement is taking place among the Haitian people. As economic conditions change for the better there will be less overcrowding, a better food supply, and increased facilities for hygienic living. Popular education has been a powerful weapon in the fight against tuberculosis and the medical profession in Haiti could render the country a great service through the organization of a campaign for the popularization of information concerning the disease by means of lectures, the cinema, posters, and the press. The National Health Service, as its finances and personnel permit, will undoubtedly consider the development of special hospitals and sanatoria for the isolation and treatment of the disease. The early diagnosis of tuberculosis is of the utmost importance, and to this end the organization of tuberculosis clinics in the capital and the larger towns is a question worthy of careful consideration. Early diagnosis offers the patient a good chance for recovery and is of enormous value in limiting the spread of the malady. In connection with the early diagnosis of tuberculosis attention has often been called to the frequency with which the onset of the disease is with symptoms suggesting malarial fever. Owing to the prevalence of malaria in Haiti this is a point which should always be borne in mind.

RABIES

REPORT OF TWO CASES

By U. R. WEBB, Captain, and F. W. MULLER, Lieutenant Commander, Medical Corps, United States Navy

Étiology and bacteriology.—The cause of this specific infectious disease is unknown. It is communicated by inoculation with a virus from a diseased animal. The specific microorganism has not been isolated. Some authorities believe it may be a bacillus, while others think it may be of the plasmodial type. As a fine filter paper removes the infection from a solution, the weight of opinion favors the latter. The blood and lymphatics of a diseased animal seem to be free from this virus. It is found in the central nervous system, nerves, and glands. As the gastric juice destroys the virus in 40 to 50 minutes, the flesh of animals that died of this disease may be eaten by animals without infecting them, provided there are no breaks in the mucous membrane of the mouth or throat.

The saliva of rabid animals contains the infection. The disease has been produced in rabbits from the saliva of man and animals

The most common method of infection is from the bite of the dog or cat. It occurs in all warm-blooded animals, including birds. From 30 to 50 per cent of humans bitten by a rabid animal develop the disease. Nursing humans and animals may be inoculated through a break in the mucous membrane of the mouth or throat.

Distribution.—The disease exists in every State of the United States and every country of the world except Australia. While no statistics are available, physicians in China say it is common there.

Incubation.—The period of incubation ranges from 10 days to 15 months, usually about 20 to 90 days. Death always occurs in from two to eight days after the onset of the disease.

Rabies in the dog.—There are two types of the disease in the dog—virulent or rabid, and the dumb or paralytic. Both forms are dangerous. The animal rarely has fits, and drinks water freely until the stage of paralysis occurs. It may have tremors or muscular spasms. Suspicious animals should be isolated and not killed. The course of the disease is usually four to five days, rarely exceeding 10 days.

According to some authorities, the spread of this disease may be prevented by yearly immunization of the dog with a single vaccination. Some authorities do not agree with this method of procedure and believe that the rigid enforcing of muzzling laws is best. If wolves, coyotes, etc., throughout the country were killed and all dogs quarantined for six months, this disease would be wiped out.

Pathology.—The pathology is given in detail in the case reports of the two typical cases cited below.

Symptoms.—Certain prodromal symptoms may be present for a day or two. They usually consist of headache, loss of appetite, great depression of spirits, sleeplessness, and sometimes darting pains in various parts of the body. These premonitory symptoms are followed by the stage of excitement.

Quite early in the stage of excitement the patient dreads the sight or sound of water. This is probably due to fear of inducing a painful spasm of the larynx. These spasmodic, painful contractions of the larynx become so strong as to cause dyspnea and the emission of curious sounds. The muscles of the mouth may exhibit convulsive movements, causing a snapping sound, and thick saliva is ejected from the mouth. Hyperesthesia is present and gradually becomes more marked, so that any noise or draft of air causes a violent reflex spasmodic contraction of the larynx. The patient develops the keenest vigilance and desires to be left entirely alone. The mind is usually clear. These symptoms occur in paroxysms, and during the intervals the patient is quite calm, although mentally alert, being fearful that something may happen to cause one of the painful spasms

of the larynx. The temperature usually ranges from 100° to 102° F. (37.7° to 38.8° C.), but fever may be absent. The pulse is moderately accelerated and sometimes irregular. Toward the end of this stage reflex spasms of the respiratory apparatus develop. Often mental aberrations and melancholia ensue, followed by suicidal tendencies, and mechanical restraint is necessary. This stage is followed by the paralytic stage.

The paralytic stage may last from 12 to 18 hours, but is usually much shorter. There are no spasms, and the patient passes into coma and death.

Diagnosis.—Hysteria may be misleading, but the previous history may suffice. The brain or medulla of the rabid animal that has inflicted the bite should be sent to a laboratory for examination, if possible. Subdural inoculation of a rabbit should be made with bits of brain substance or medulla of the rabid animal. (See case reports for laboratory findings.)

Prognosis.—No case of rabies in the human has been known to recover.

TREATMENT

Prophylaxis.—After the disease has developed no treatment is of any avail. A wound produced by the teeth of an animal, even though it be a slight abrasion of the skin, should be immediately cauterized with pure nitric acid. If the animal has rabies, or if there is the least doubt, the immunizing treatment should be given.

Immunization.—The Pasteur immunization treatment consists of 25 hypodermic injections in 21 days of an emulsion of spinal cord, attenuated by drying, of rabbits dead of rabies. Local reactions following this treatment are trivial. Paralysis occurs occasionally and may be fatal.

The Semple modification of the Pasteur immunization treatment consists of 14 hypodermic injections of two mils each given on each succeeding day. It is now used with very good results throughout India, Burma, Egypt, Japan, Mesopotamia, Milan, Palestine, Sardinia, Shanghai, Warsaw, Peking, some parts of the United States, and other places. The local reactions are trivial and no cases of paralysis or deaths resulting from the treatment have been reported.

The maximum degree of immunity is developed about two weeks after the full course of treatment is completed. The following method of preparation is outlined by Dr. P. Z. King, Acting Chief, Department of Epidemiology, National Epidemic Prevention Bureau, Peking, China:

Healthy rabbits are inoculated intracerebrally in the usual manner with 0.2 c. c. of a suspension of fixed rabies virus in sterile physiological salt solution. When the animals show complete paralysis, at the end of the seventh or

eighth day, they are bled to death by cutting the blood vessels of the neck. The brains and cords are removed under strictly aseptic precautions, placed in a sterile Petri dish, and weighed. They are next reduced to a fine emulsion by grinding in a sterile mortar, and enough sterile 1 per cent phenol saline (1 c. c. of chemically pure phenol to 99 c. c. of a 0.85 per cent sodium chloride solution) is added gradually to make up a 6 per cent suspension. This suspension is then strained through a piece of sterile fine muslin in order to remove coarse particles. The filtrate is placed in a sterile flask and kept in the incubator at 37° C. for 24 hours, at the end of which time it is taken out and diluted with an equal volume of 0.85 per cent sodium chloride solution without phenol, thus becoming a 3 per cent brain and cord suspension in 0.5 per cent phenol saline which constitutes the phenolized rabies vaccine. Before bottling, each lot of vaccine is subjected to sterility, toxicity, and viability tests.

The Cumming modification consists of 21 injections in severe cases and 14 in mild cases. Immunization of the lower animals, according to the Hogenes treatment, consists of two the first day, two the second day, one the third day, and one the sixth day.

During any immunization treatment the patient should avoid fatigue, cold, or chilling, emotional stress, trauma, and stimulating drinks, as strong tea, coffee, and alcoholic beverages. Cold baths should be avoided, but warm or tepid ones are permissible. The bowels should be kept quite free.

CASE REPORTS

CASE 1.—C. P. W.; male; age, 26 years; white; admitted December 26, 1927.

CLINICAL HISTORY

Chief complaint.—Pain in back of neck and shoulders for past two days.

Personal history.—Has been well since childhood, during which he had chicken pox, measles, and mumps. Chancroid, penis, since entering United States Marine Corps, with blood tests for syphilis repeatedly negative. A member of the mounted detachment, American Legation Guard, Peking, China. About two weeks prior to this admission, bitten on the left breast by a horse. Was bitten through his clothing and no abrasion of the skin resulted. Horse is well at the present time. Reported to have been talking obscenely and writing obscene stories for the past few days, which was contrary to his former conduct. Denies having been bitten by a dog or cat, or owning one.

Present illness.—On admission, complained of sharp, shooting pains in back of neck and shoulders. This condition has been present for the past two days, steadily becoming worse. Had been well prior to that time.

Physical examination.—Essentially negative, except for great depression and slight fever.

Course of disease.—December 27 and 28, 1927, the pain and depression had practically disappeared and there was no fever. There was a mild cough. December 29, 1927, patient complained of some difficulty in swallowing liquids. He could swallow a crust of dry bread with no difficulty. There was cough, with a temperature ranging from 99.6° to 101° F. December 30, 1927, all symptoms were more pronounced, with physical signs of a broncho-pneumonia. Temperature, 100° to 102° F. December 31, 1927, condition same as previous

day. January 1, 1928, he became very restless. Coarse tremors and incoordination of the limbs were present. When urged to take a swallow of water, after a great deal of hesitation, he took a deep inspiration with the emission of a curious sound. This was followed by a reflex spasm of the muscles of the larynx and fauces. Mind was clear, except at times when he thought he was at home. Patient refused all nourishment by mouth. January 2, 1928, hyperesthesia present to a marked degree. Any slight noise, dripping or sight of water, draft or air, or spoken voice caused a reflex spasm of the muscles of the larynx and fauces. Muscles of the mouth exhibited convulsive movements, causing a snapping sound. Great restlessness with rolling of the head was present. Patient wore an expression of most intense anxiety and was mentally alert. The spasms occurred in paroxysms. When free from them, he was fearful lest something be done to produce one. Later, this anxiety increased so that he became very abusive and noncooperative, and mechanical restraint was necessary.

Examination.—Lungs showed physical signs of broncho-pneumonia. Heart, normal. Abdomen, normal. Urine: Albumen, 4 plus; many granular casts and a few red and white blood cells. Blood: Red blood corpuscles, 5,000,000; white blood corpuscles, 9,950. Temperature, 102° F.; pulse, 124; respiration, 30. Patient continued in a maniacal state for about five hours and then passed into coma for about an hour, and died at 12.30 a. m. January 3, 1928.

Clinical diagnosis.—Broncho-pneumonia. (Rabies (?).)

AUTOPSY REPORT

MICROSCOPIC EXAMINATION

Body.—The body is that of a very well-nourished, muscular young man weighing 59 kilograms and measuring 172 centimeters in length. Rigor mortis is marked, and the face, neck, thorax, and dependent portions of the body show great post-mortem lividity. The head is of normal size and shape, and thickly covered by coarse black hair. The eyes, nose, ears, mouth, and neck show no noteworthy changes. The thorax is well formed and symmetrical. The abdomen is flat. The penis shows an old, flat, healed scar on the right side just behind the corona. The testes are not remarkable. The extremities are well formed and show no pathological changes. The cervical, axillary, epitrochlear, and inguinal lymph glands are not enlarged. Over the second metacarpal joint of the right index finger is a small recent abrasion. No other scars were found on surface of the body. There is no edema. Along the primary incision is a small amount of bright yellow fat. The pectoral and abdominal muscles are unusually well developed and of dark red color. There is a small fresh hemorrhage in the left pectoralis major muscle just below the level of the nipple.

Peritoneal cavity.—The peritoneal cavity contains no free fluid. Its surfaces are smooth and glistening. There are a few delicate fibrous adhesions about the terminal portion of the ileum which bind several of the loops to each other and to the parietal peritoneum. The omentum is attached loosely to the gall bladder by similar thin bands of fibrous tissue. The liver, spleen, appendix, mesenteric lymph glands, and pelvic organs show no gross changes. Upon removing the sternum about 50 cubic centimeters of clear, slightly blood-tinged fluid is found in each pleural cavity. There are no pleural adhesions. The pericardium contains about 20 cubic centimeters of clear, thin, pale-yellow fluid. Its lining is delicate, smooth, and glistening. The heart is of normal

size. A small amount of thymus tissue was found in the superior anterior mediastinum.

Heart.—Weight, 300 grams. Measurements: Valve circumferences, tricuspid 12 cubic centimeters; mitral, 10 cubic centimeters; pulmonic, 10 cubic centimeters; aortic, 7.5 cubic centimeters. Thickness of left ventricular wall, 14 millimeters. Thickness of right ventricular wall, 4 millimeters. The heart is of normal size, color, and consistency. The epicardium is delicate, smooth, and glistening. Upon opening the heart, no alteration of the endocardium or valves is seen. The cavities of both the right and left sides of the heart are of normal size; the myocardium is of dark-red color, firm, and shows no alterations. Several small patches of atheroma were found in the intima of the left coronary artery. These offered no obstruction to the lumen. The aorta is elastic but shows a number of streaks and small patches of atheroma along its posterior wall.

Lungs.—Left, 890 grams; right, 840 grams. The left lung is of dark, reddish-blue color, and very heavy. The pleura, except for a few small scars at the apex, is smooth and glistening. The anterior portions of both lobes are soft and crepitant, but in the posterior portions a number of irregular, firm, nonair-containing areas are felt. On section several firm, deeply pigmented scars are found in the apex of the upper lobe, and one circumscribed caseous and calcified area about 0.5 centimeter in diameter surrounded by a dense hyaline wall is present in the base of the upper lobe. The cut surface is of dark-red, mottled appearance and drips copiously with frothy fluid. In the posterior part of both the upper and lower lobes are many irregular, dark-red areas varying from 1 to 2 centimeters each in diameter, which are slightly elevated, firm, and contain no air. These areas have central bronchi and bronchioles from which large amounts of purulent exudate may be expressed. The anterior portions of the upper and lower lobes are air containing throughout, but are very moist and hyperemic. The large bronchi contain much frothy, bloody fluid, and show marked hyperemia of their mucosa. Two small lymph glands at the hilum lying along the superior bronchus show areas of calcification. No areas of calcification or old scars were found in the right lung. In other respects it closely resembles the left one. No areas of consolidation were found in the middle lobe.

Spleen.—Weight, 180 grams. Measurements, 12 by 8 by 4 centimeters. The spleen is moderately enlarged and somewhat softer than normal. The capsule is delicate, smooth, and glistening. On section, the pulp is seen to be of homogeneous, purplish red color and greatly engorged with blood. The Malpighian bodies are rather indistinct. The reticulum is not increased in amount. Two minute calcified nodules, each about 1 millimeter in diameter, were found in the splenic pulp.

Liver.—Weight, 1,690 grams. Measurements, 26 by 20 by 7 centimeters. The liver is also moderately enlarged and a little softer than normal. The capsule is smooth and glistening. The cut surface is of mottled brownish red color, and bulges greatly over the cut edge. The lobules are intact, but much swollen, and of opaque appearance. One small, circumscribed calcified nodule about 3 millimeters in diameter is present in right lobe. The gall-bladder bile ducts and blood vessels show no alterations.

Stomach and duodenum.—Normal. The stomach contains about 30 cubic centimeters of clear fluid and a few small bits of white flaky material.

Pancreas.—Weight, about 90 grams. Normal in size and consistency. The lobules are well preserved.

Adrenals.—Weight, left, 15 grams; right, 14 grams. The adrenals are of normal size and consistency. On section, the cortex is found to be well preserved and of pale yellow color. The medulla is of dark brown color and intact.

Kidneys.—Left: Weight, 170 grams. Measurements: 11 by 5 by 4 centimeters. Right: Weight, 180 grams. Measurements: 11.5 by 5 by 4 centimeters. The left kidney is considerably swollen. The capsule strips readily, leaving a smooth, very hyperemic, dark-red surface. On section, all parts of the renal architecture appear to be intact but are greatly swollen and very soft and opaque. The glomeruli stand out prominently as bright red dots, and all of the other renal vessels are engorged with blood. The renal pelvis and ureter show no changes other than moderate hyperemia. The right kidney, renal pelvis, and ureter closely resemble the corresponding structures on the left side.

Intestine and mesentery.—The wall of the entire intestine is of normal thickness and the mucosa is intact. Peyer's patches and the lymphoid follicles of the colon are somewhat larger than usual and show slight greyish brown pigmentation. The mesenteric lymph glands are not altered.

Bladder, prostate, seminal vesicles, and testes.—Show no anatomical changes.

Bone marrow of femur.—Moderately abundant, soft, of greyish-red color, and contains considerable fat.

Brain.—Upon removing the skull it was seen to be unusually thin in several irregularly shaped areas along the superior longitudinal sinus. The dura shows no abnormalities. The brain is swollen and the pia arachnoid is hyperemic.

Anatomical diagnosis.—Rabies; purulent confluent lobular pneumonia; parenchymatous degeneration of kidneys; cloudy swelling of liver; acute splenic tumor; edema of lungs; hyperplasia of lymphoid tissue in ileum and colon; healed tubercles in left lung, bronchial lymph glands, liver, and spleen.

MICROSCOPICAL NOTES

Lungs.—Sections of lung show no alteration of the surface of the pleura. The bronchi and alveoli are filled with coagulated fluid, fibrin, blood, and many polymorphonuclear leucocytes. The lymphatics of the pleura, interlobular septa, and bronchial walls are widely distended and filled with coagulated fluid.

Bone marrow of femur.—The bone marrow taken from the middle of the femur is composed only of fat cells embedded in a network of capillaries engorged with blood. No hematopoiesis was seen.

Liver, spleen, kidneys.—Show considerable engorgement with blood.

Intestines, pancreas, prostate, testes, adrenals, thymus, gall bladder, hypophysis, heart.—Show no noteworthy changes.

BACTERIOLOGICAL REPORT

Cultures of heart's blood, spleen, liver, and bile inoculated on blood agar plates and in broth gave no growth in 48 hours' incubation. Cultures of the left and right lung inoculated on blood agar plates gave growth to small, non-hemolytic, round and flat colonies, smears from which Gram-positive, lancet-shaped diplococci, surrounded by capsule. The microorganism was bile-soluble and agglutinated against immune sera Type I, II, and III, but showed no agglutination with pneumococcus serum Type IV. Cultures of intestine inoculated on china blue plates gave growth to bluish colonies, smears from which stained as Gram-negative rods. When tested for fermentation these showed changes in dextrose, maltose, mannite, and lactose typical of *B. coli communis*.

Bacteriological diagnosis.—*Pneumococcus*, Type IV, from lung. *B. coli communis* from intestine.

REPORT ON ANIMAL INOCULATION FOR RABIES

Pieces of medulla oblongata and cornu Ammonii, obtained at the autopsy, were emulsified in physiological salt solution and 0.1 c. c. of the emulsion was injected into the brains of a guinea pig and a rabbit. The guinea pig developed a clinical picture of rabies and died on the thirteenth day after inoculation. The rabbit developed rabies and died in 16 days. The histological sections of the brain of both animals showed the presence of Negri bodies.

NEUROLOGICAL REPORT

Microscopia.—Smears from motor cortex show a great many Negri bodies in the ganglion cells. The cortex shows extensive ganglion cell degeneration, in some places really very marked. This is combined with proliferation of satellite glia cells and detritus transportation along the blood vessels in the white matter. There is no perivascular lymphocytic infiltration, and it is rare to find endothelial proliferation of smaller vessels. The microglia is normal; no red cells are found. The pia is thickened, but this is an old process; no infiltration.

Negri bodies are present in a great number of the ganglion cells; in some places one out of six cells shows them and often two or three lie in one cell. Their size varies a great deal. They are found sometimes present in the degenerated ganglion cells, of which the nuclei are nearly resorbed.

Cerebellum.—There is degeneration of Purkinje cells, but not very extensive. However, a number of these cells seems to have disappeared altogether. No meningeal or vascular irritation. The Purkinje cells contain a great many Negri bodies, of varying size; sometimes as large as the nucleus.

Pons-mesencephalon.—The meninges are thickened; infiltration is however very insignificant. The nervous tissue is affected in various ways.

1. *Perivascular small lymphocytic infiltration:* This is most marked in the dorsal part, in and around the oculo-motor nuclei, and in the quadrigeminal plate. Sometimes four or five rows of cells lie in the vessel sheath. The ventral tegmental part shows this change to a less degree and in the pons it is difficult to find perivascular sleeves.

2. *Lymphocytic infiltration in the nervous tissue:* This is quite marked around some of the vessels, as mentioned in the foregoing paragraph, but also occurs in foci without relation to blood vessels, and then in combination with the following foci.

3. *Foci of microglia proliferation:* These lie in the gray matter of all three divisions of the section, less in the pons than in tegmentum and tectum.

4. *Diffuse glia proliferation in eye muscle nuclei and some parts of the quadrigeminal plate:* Increase in small nuclei.

5. *Ganglion cell degeneration:* This is very marked in the third nerve nucleus, where the cell nucleus of many nerve cells has disappeared, and the cell body is swollen. But also in the pons we find the same picture. The nerve ganglion cells show vacuolization of their protoplasm, with formation of a brownish pigment (haem. eosin) and disappearance of the nucleus.

6. *Negri bodies:* These were not seen in the third nerve root cells, but they were numerous in the smaller ganglion cells near by. Not many were found in the pons cells.

Spinal cord.—Inflammatory changes were insignificant. Negri bodies were found in the motor cells, but they were small and not frequent.

CONCLUSION

This brain shows the typical changes of hydrophobia; Negri bodies in the larger ganglion cells, small lymphocytic perivascular infiltration (in the mesencephalon), and encephalitic foci, consisting of lymphocyte and microglia proliferation (pons and mesencephalon).

In addition there is a very marked chronic ganglion cell degeneration in cortex and cerebellum, and hyperplastic meningitis, probably due to chronic alcoholism. Whether the degeneration of the oculo motor ganglion cells is due to the hydrophobia or to alcoholism can not be stated, but it seems more probable that it is due to the acute process.

SUMMARY

A typical case of rabies, proved to be such by animal inoculations, as well as by the demonstration of numerous Negri bodies in the ganglion cells of the brain. There were also found evidences of healed infection with tuberculosis and extensive purulent confluent lobular pneumonia.

CASE 2.—H. G. F.; male; age, 28 years; white; admitted, Jan. 3, 1928.

CLINICAL HISTORY

Chief complaint.—Pain in right ear, right side of head, and neck.

Personal history.—Has been perfectly well since childhood, during which he had measles, mumps, and diphtheria. A member of the mounted detachment, American legation guard, Peking, China. Denies having been bitten by a dog or cat or owning one.

Present illness.—On admission patient complained of pain in the right ear and right side of head and neck for past 24 hours. Has been well prior to this time.

Physical examination.—Essentially negative, except for some tenderness in the posterior wall of external canal of right ear. Temperature, 99° F.; pulse, 70; respiration, 18.

Course of disease.—January 4, 1928, there was pain below the right ear. Temperature, 102° F.; pulse, 120; respiration, 20; W. B. C., 8,000. January 5, 1928, condition same. January 6, 1928, symptoms less pronounced. Temperature, 99.4° F.; pulse, 84; respiration, 18. January 7, 1928, pain entirely disappeared. Patient appeared to be loquacious, had difficulty in pronouncing words, and was rather excitable. Temperature, 99.2° F. January 8, 1928, marked hyperesthesia and intention tremor. After great hesitation, would take a swallow of water, always preceded by a deep inspiration with the emission of a curious sound. For about two hours was mentally depressed. Temperature, 102° F.; pulse, 126; respiration, 20; W. B. C., 8,350; R. B. C., 5,120,000. Later, became mentally alert with an expression of extreme anxiety. Muscles of mouth exhibited convulsive movements causing a snapping sound. Hyperesthesia soon became marked. Any noise or spoken voice caused a reflex spasm of the larynx and fauces. Patient bit one attendant on the finger. He became wild and tried to fight people near him. Broke a glass door causing an injury to his right forearm. Mechanical restraint necessary. Stated that he knew everything that he did, but could not control himself. At 2.45 a. m., January 9, 1928, patient became unconscious, and died at 3.03 a. m. A lumbar

puncture was made after death and two mills of clear, colorless fluid was obtained. Culture showed no growth and Wassermann test was negative.

Clinical diagnosis.—Rabies.

AUTOPSY REPORT

MACROSCOPIC EXAMINATION

Body.—The body is that of a well developed and nourished male, weighing 56.5 kilograms, and measuring 173 centimeters in length. Rigor mortis is present and there is marked livor mortis in the dependent parts of the body. The head is of normal size and shape. Both scleræ are slightly cloudy. Pupils, equal and regular, each measuring 2.5 millimeters in diameter. Mouth, nose, and ears are not remarkable. The teeth are in fairly good condition. The thyroid is not enlarged. The chest is symmetrical. The abdomen is slightly distended. The external genitalia show no lesions. The extremities show no abnormalities except slight injury of right forearm.

Peritoneal cavity.—The subcutaneous fat is well preserved. The pectoral and abdominal muscles are dark red in color. The peritoneal cavity contains no free fluid. The serous surfaces are smooth and glistening. The spleen is slightly enlarged. The liver is of normal size. The appendix is of normal appearance.

Pleural cavity.—The pleural cavities contain no fluid and their surfaces are smooth and glistening. The lungs are fairly voluminous, soft, and their surfaces are dark grayish in color and in places show dark red areas. The heart is of normal size and consistency. The epicardium is of normal thickness, and its lining smooth and glistening. It contains about 7 cubic centimeters of clear straw-colored fluid. The thymus is in places replaced by fat and fibrous tissue and on section shows no pathological changes.

Heart.—Weight, 290 grams. Valve measurements: Tricuspid, 12 centimeters; mitral, 8 centimeters; pulmonary, 7 centimeters; aortic, 6 centimeters. Thickness of the left ventricular wall, 13 millimeters. Thickness of the right ventricular wall, 4 millimeters. The heart is of normal size and consistency. Both auricles and ventricles show no changes. All the blood vessels and valves are normal. Aorta is elastic throughout except for presence of some small longitudinal yellowish lines in the intima; otherwise, not remarkable.

Lungs.—Left lung weighs 515 grams. Right lung weighs 520 grams. Both lungs are dark grayish in color; their pleuræ are smooth and glistening except for presence of some dark red areas in places. Consistency is soft. On section the cut surfaces are grayish red in color. There is no area of consolidation present. The bronchial lymph nodes are of normal size and consistency and on section show no pathological changes.

Spleen.—Weight, 265 grams. Measures 13 by 6 by 4 centimeters. It is slightly enlarged and of normal consistency. The capsule shows no alterations. On section the cut surfaces are dark red in color. The Malpighian bodies are fairly distinct. The interstitial tissue is not remarkable. Accessory spleen present.

Liver.—Weighs 1,460 grams. Measures 27 by 19 by 6 centimeters. The liver is of normal size and consistency. Its capsule is smooth, delicate, and glistening. On section, the cut surfaces are dark reddish brown in color. The lobules are of normal size and well preserved. The gall bladder is of normal size and its wall of normal thickness; its mucosa is intact. It contains about 10 cubic centimeters of clear thin, dark brown bile. The bile ducts show no changes.

Pancreas.—Weight, 70 grams. It is of normal size and consistency and on section shows no changes. Its duct is patent.

Adrenals.—Left—weight, 6 grams; right—weight, 5 grams. The adrenals are slightly smaller than normal. On section the cut surfaces are not remarkable except for slight congestion.

Kidneys.—Left weighs 155 grams and measures 11.5 by 7 by 4 centimeters. Right weighs 150 grams and measures 11 by 7 by 4 centimeters. Both kidneys are of normal size and consistency. Their capsules stripped off easily, leaving dark, smooth, reddish brown surfaces. On section the cut surfaces show that the cortex is of normal thickness and the striations straight and regular, and the medulla of normal markings except for congestion. Both renal pelves and ureters show no changes.

Bladder.—The bladder is moderately distended with about 100 cubic centimeters of clear urine. Its wall is of normal thickness. Its mucosa is delicate and intact. Its trigone shows no changes.

Prostate, seminal vesicles, testes.—Show no gross pathological changes.

Intestines.—The small and large intestines are normal except for presence of congestion.

Neck organs.—The thyroid, pharynx, larynx, esophagus, tongue, and trachea show no pathological changes.

Bone.—In the petrous portion of the right temporal bone there is fresh hemorrhage, probably caused by trauma during struggles. The right temporal bone is normal.

Anatomical diagnosis.—Rabies; hemorrhage in the petrous portion of the right temporal bone; lobular pneumonia; congestion of all internal organs; accessory spleen.

MICROSCOPICAL NOTES

Heart.—Section of heart shows nothing remarkable.

Aorta.—Shows slight thickening of the intima in a few places. The media and adventitia show no changes.

Thymus.—Shows tissue in places replaced by fat and fibrous tissue. There are several hyalinized Hassall bodies present. The blood vessels are congested.

Lungs.—Sections of both lungs show that the pleura is not remarkable. The alveoli are small and in places show great thickening of their walls with marked congestion; edema and infiltration by many phagocytic cells and a few leucocytes. The bronchi show no striking changes. In one section near the bronchus there is a small lymph node showing congestion of the blood vessels and slight infiltration by leucocytes in the stroma.

Spleen.—The spleen is greatly congested. The Malpighian bodies are not remarkable except for slight thickening of the blood vessels. The accessory spleen shows similar changes.

Liver.—The capsule is not altered. The liver cells contain light yellow pigment and many small vacuoles, apparently fat globules. The sinusoids are moderately congested.

Adrenals.—Show no striking changes except for moderate congestion.

Kidneys.—The capsules are not altered. The tubules are slightly swollen. The glomeruli and blood vessels are moderately congested.

Pancreas.—Shows congestion of the blood vessels and a few areas of post-mortem changes.

Bladder.—Shows no striking changes.

Prostate.—Shows congestion of the blood vessels; otherwise not remarkable.

Intestine.—Sections of intestine show that the mucosa is intact. The sub-mucosa shows congestion of the blood vessels. The muscularis and serosa show no changes.

Mesenteric lymph nodes.—Show slight hyperplasia of some lymph follicles. The sinuses are large and contain many mononuclear cells and a small number of leucocytes.

Hypophysis.—Shows nothing remarkable except for moderate congestion of the blood vessels.

Bone.—Sections of the petrous portion of the right temporal bone shows that the trabeculae are not remarkable and are lined by a layer of endothelium. The spaces of the trabeculae are filled with blood.

BACTERIOLOGICAL REPORT

Cultures of heart's blood, bile, liver, and kidney inoculated on blood agar plates and in broth gave no growth in 48 hours' incubation. Cultures of the left lung inoculated on blood agar plates gave growth to minute round, non-hemolytic colonies, of Gram-negative rods. The organism does not grow on simple bacteriological medio—*B. Influenza* (probably). A guinea pig and rabbit were inoculated with a brain emulsion, obtained by emulsifying pieces of medulla oblongata, cornu ammonii, and motor area in physiological salt solution. This emulsion was injected (0.1 cubic centimeter each) into brains of two animals. Both animals, guinea pig and rabbit, developed typical pictures of rabies, the guinea pig dying in 17 days and the rabbit in 16 days. The inoculation of the animals was performed on January 9, 1928.

Bacteriological diagnosis.—No growth from heart's blood, bile, liver, and kidney. *B. influenza* (probably) from lung.

NEUROLOGICAL REPORT

Macroscopic.—Brain a little hyperemic.

Microscopic.—The meninges are somewhat edematous, and contain many cells, most of which are large lymphocytes.

There is perivascular infiltration of lymph spaces.

In the motor area we find all Betz cells stain very little with Nissl stain; the tigroid masses are gone, and the nucleus is eccentric. The other cells also show signs of acute degeneration. Neuronophagia is not very evident. Glia proliferation is unimportant. There is no perivascular infiltration. The frontal cortex shows the same changes as the motor; in the calcarine area cell degeneration is much less.

Ammon's horn shows no changes. Basal ganglia: There is one corner near the anterior commissure where we find some perivascular infiltration with small lymphocytes and some larger cells. Dorsal to the mammillary body these changes are more marked; the infiltration is chiefly mononuclear, and there are some foci in the nervous tissue.

Medulla.—No infiltrations; no encephalitic foci. Many large ganglion cells (olives and others) are swollen and show chromatolysis.

The cerebellum is normal, except for a few places of increased glia tissue in the superficial layer.

The choroid plexus is hyperemic and edematous, and contains calcium deposits in a fibrous part. The epithelial cells do not show degeneration, but many contain clear vacuoles. No inflammation.

Negri bodies are very numerous in the cortical ganglion cells, especially in the large cells of the Ammon's horn. The Purkinje cells also contain many Negri bodies.

CONCLUSION

The changes found in this case point to hydrophobia, although the encephalitic lesions are not so marked as in the first case. Negri bodies are as frequent as in the other. In this case, as in the other, it should be noted that Negri bodies are not present in the cells showing the acute degeneration in the encephalitic areas. Chromatolysis of the large cells is one of the outstanding features.

DISCUSSION

A statement was made by a member of the mounted detachment a few days after the second death from rabies. He said that a young dog, which had been raised in the compound, had been less active and playful for a day or two. It was believed that the animal might have "worms." He and the two deceased gave the dog some castor oil. Although the animal offered some resistance, it did not bite any one of the three. As the dog was young and its teeth sharp, each received a few minor abrasions of the skin of his hands. The abrasions did not bleed and were so very slight that the men believed no medical attention necessary. Both of the deceased denied having been bitten by a dog, the slight abrasion having been entirely forgotten. Soon after receiving the dose of oil the dog disappeared. This was unusual, as the dog seldom left the compound. He believed this occurred in late October or early November.

The dog probably had the dumb form of rabies. As the literature emphasizes inoculation in deep lacerations of the skin, it is of interest to note that each of the three men received only slight abrasions of the skin of the hands. This is undoubtedly a common occurrence among persons who attempt to treat sick animals and it is often believed unnecessary to cauterize such wounds. The period of incubation was indefinite—40 to 60 days.

One of the early symptoms in each case was great hesitation, followed by a deep inspiration with the emission of a curious sound, preceding a single swallow of liquid. The first patient could swallow a crust of dry bread at the time he declared he could not swallow water. The stage of coma in each case was shorter than it commonly is—about 60 minutes in the first case and 20 in the second.

An order was issued for all members of the legation guard who had been bitten by a dog within the past year to report to the dispensary. Fifty-seven persons received the Semple treatment. This included five who had taken care of the two deceased and had come in contact with their sputa. One Hospital Corps man was bitten on the finger by the second patient. The wound was immediately cauterized with pure nitric acid. He was included with the five attendants

who received the Semple treatment. Only trivial local reactions followed the treatment. There was no paralysis or fatality. The third man, who helped treat the sick dog, was very anxious and excitable during his course of treatment, probably due to worry. No new cases developed.

All dogs in the compound received a single vaccination against rabies. This vaccination caused no illness among the animals.

CONCLUSION

In civilized countries practically all cases of human rabies are caused by the bite of domestic dogs. Every dog bite, therefore, is a source of potential danger.

Humans may be inoculated with the virus of this disease through a slight abrasion of the skin or mucous membrane. Any abrasion of the skin produced by the teeth of an animal should be immediately cauterized with pure nitric acid, and the animal should be isolated and kept under observation for a period of 10 days. If the animal is well at the end of the 10 days, there is no danger from the bite. If, however, for any reason, it is impossible to keep the animal under observation for 10 days, the immunization treatment should be given at once.

A dog showing questionable symptoms of rabies should be isolated and kept under observation for a least 10 days. If positive symptoms develop, it should be killed and the brain sent to a laboratory for examination. If the animal dies within 10 days this examination should be made.

The Semple form of immunization treatment appears to be efficacious with comparatively few complications.

An early symptom of this disease in the human is, when he is urged to take a swallow of liquid, great hesitation followed by a deep inspiration with the emission of a curious sound preceding the swallow.

The clinical diagnosis in each case was confirmed by autopsy and animal inoculation.

One of the principal methods of prevention for this disease is rigid enforcement of muzzling laws. The best method would be to rid the country of wolves, coyotes, etc., and quarantine all dogs for a period of six months.

NOTE.—The autopsy and laboratory reports are by Drs. J. R. Cash, T. Kurochkin, and E. de Vries, Peking Union Medical College, Peking, China.

AGRANULOCYTIC ANGINA

REPORT OF CASE

By E. A. SHARP, Lieutenant Commander, Medical Corps, United States Navy, and C. A. SETTERSTROM, Chief Pharmacist, United States Navy

Septic sore throat is described by Price (1) and others as acute septic pharyngitis, acute ulcerative pharyngitis, gangrenous pharyngitis, erysipelas of the throat, and Ludwig's angina. The latter condition has for its exciting cause a pharyngeal sepsis which extends into the sublingual tissue.

The course of the disease in respect to the local throat condition varies from a panpharyngitis with exudate and edema, to deep and destructive ulcerations involving the uvula, faucial pillars, and tonsils. General symptoms are those of sepsis: Hectic fever, chills, prostration, delirium, diaphoresis, and leucocytosis. *Streptococcus pyogenes* is usually the causative organism. The mortality, not uncommonly occurring within two or three days after the onset, is high and is the result of septicemia.

REPORT OF CASE

History.—E. A. B., EMlc, United States Navy, aged 24 years, was admitted March 5, 1928, complaining of sore throat of two days' duration. Dysphagia, headache, and prostration were concomitant signs and symptoms.

Past history.—Unimportant, but interesting in that he had a gunshot wound of the left side of the neck in 1926 with a consequent arteriovenous aneurism which was extirpated several months afterwards.

Physical examination.—Well developed man of hyposthenic habitus. Skin, clear except for a black keratosis of the palmar and lateral aspects of the fingers of both hands. Ears, normal. Scleræ of both eyes injected. The pupil of the left eye was smaller than the right; both reacted sluggishly to light and to distance. Nasal mucosa, hyperemic, and a serosanguineous discharge was present. Tongue, tonic, dry, and coated. Breath, foul. Teeth, in good condition. There was a marked hyperemia and edema of all pharyngeal structures, with discrete patches of grayish yellow exudate, varying in size from several millimeters to a centimeter in diameter, involving the uvula, soft palate, faucial pillars, and tonsils. The membrane could be removed easily. A linear scar 10 centimeters in length on the left side of the neck, parallel to the anterior border of the sternocleidomastoid muscle, marked the site of the operation for excision of the aneurism in 1926.

No other physical defects were found. Heart sounds, normal. Blood pressure: Systolic 112; diastolic 35. Temperature was 102° F., pulse, 105, and respirations, 28.

Laboratory findings.—Urine, feces, and sputum showed no abnormalities. Kahn reaction was negative. Streptococci, a few spirillae, and fusiform bacilli were found in smears from the throat. *Bacillus diphtheriae* was not found in smears or culture from the throat. A culture from the infected pharynx demonstrated a Gram-negative coccus of a nonhemolytic type. Blood culture was negative. Upon admission the blood examination revealed: Erythrocytes, 4,500,000; hemoglobin (Tallquist), 70 per cent; leucocytes, 3,500;

polymorphonuclears, 2 per cent; lymphocytes, 96 per cent; large mononuclears, 2 per cent. (A blood examination with the same pipette was done on a normal man immediately as a control and showed 7,600 leucocytes and a normal differential count.)

TABLE 1

2 hours after admission	Second day	Third day	Fourth day
WBC—2,200. P—1 per cent. L—95 per cent. LM—4 per cent.	1,600	3,800	6,400

It will be seen in the above table that the leucocytes continued to decrease until the third day. The white cell count on the fourth day was taken 12 hours after a whole blood transfusion by the citrate method. From the time the blood examination recorded in the first column was done the leucocytes showed atypical morphology to a degree that made differential estimates undependable.

Treatment and course.—This patient became progressively worse. Anti-streptococcus serum, blood transfusion, glucose and mercurochrome solutions, intravenously, caused no beneficial change in his condition. On the evening of the second day the bases of both lungs showed signs of consolidation. The temperature, pulse, and respirations began to ascend at that time, ultimately reaching 107° F., 140 plus and 60 plus, respectively, the morning of the fourth day, when death occurred.

NEUROPSY

No unusual gross pathological lesions were found. The lower two-thirds of both lungs were consolidated. A Gram-negative streptococcus was obtained in the culture from the blood of the heart.

Microscopical.—The liver tissue was free from inflammatory infiltration, but there was some central congestion. The liver cells showed advanced granular degeneration and beginning vacuolation. They had atrophic changes with dilatation of sinuses, which contained considerable finely granular material.

No normal lung tissue was found in any of the sections. Consolidation was due to a massive extravasation of blood. The alveolar spaces were fairly distinct. Many large endothelial cells packed with pigment were found. Numerous areas of focal necrosis infiltrated with lymphocytes, endothelial cells, and a few polymorphonuclears were present. Cocci, bacilli, and spirillæ were abundant. Stained sections of these areas resembled smears of material from Vincent's ulcer.

DIAGNOSIS

The clinical features of the case, except for the blood picture, justify a diagnosis of septic sore throat. A leucopenia with a small percentage of polymorphonuclears is not a typical finding.

Agranulocytic angina was first described by Schultz in 1922. Since that time Kastlin (2), Gundrum (3) and others have reported cases. In this disease the throat condition is similar to the one just described. Jaundice and a generalized dermatitis have been observed.

Leucopenia as low as 280 was found by Gundrum (4), who was not able to isolate *Bacillus pyocyaneus* in his case, obtain a blood culture, or find an "aid in the diagnosis" after autopsy.

A PROBABLE HEALTH HAZARD

During the time this case was under observation, a shipmate of the deceased, performing the same duty, stated that all personnel in the battery overhaul room at the submarine base in this naval district suffered from sore throat during battery charging periods. For this reason an industrial survey of the charging room was undertaken by one of us (C. A. S.).

Activities of the Battery Charging Room

The possible health hazards in the battery overhaul building at the submarine base of those doing general work, as in the case of E. A. B., EM1c, United States Navy, deceased, are:

- (a) Spray of sulphuric acid from charging batteries on face and hands while taking observations.
- (b) Lead contained in electrolyte (H_2SO_4) spray.
- (c) Antimony contained in alloy of battery grids and bolts.
- (d) Hydrofluoric acid fumes. (Acid used in mixing lead paste.)
- (e) Clouds of white lead powder while mixing hydrofluoric acid with white lead.
- (f) Burning lead plates with acetylene torch.
- (g) Exposure to carbon disulphide fumes used as a rubber solvent.
- (h) Sulphuric acid spray from large lead-lined mixing vats.
- (i) Possible, but remote, danger of chlorine gas inhalation from rheostat. (Two large lead plates immersed in salt solution.)

(a) The battery overhaul shop is a roomy building with a lofty ceiling and is well ventilated by windows and large doors. The number of batteries charged at one time is usually 120. During charging there is considerable effervescence due to escape of hydrogen and oxygen. The gas bubbles carry with them small particles of sulphuric acid ranging in specific gravity from 1,150 to 1,240 (roughly 17 to 33 per cent by weight of sulphuric acid). This spray is carried by the wind and spatters on the men who take readings. The batteries are of the usual lead and sulphuric acid accumulator type. They are $49\frac{3}{4}$ inches high by 17 inches by 16 inches. When rigged for charging they are about shoulder high to the average man. While charging is in progress a man takes temperature, voltage, and specific gravity readings every hour. During discharge and toward completion of charging these readings are made every 15 minutes. It is necessary for the man to keep his eyes on a level with his instruments while making readings. Thus, he can not escape breathing some spray as well as getting some of it on his hands and face.

Chemical tests confirm that the electrolyte contains lead and the men must, therefore, be absorbing minute amounts of lead while employed on charging detail. Water is also added to the batteries about every 10 hours. As the alloy in the battery grids and bolts contains antimony there is the possibility of the absorption of minute quantities of this metal. Small amounts might be given off as stibine (SbH_3) during charging.

(b) E. A. B., deceased, worked on a platform between two lead-lined tanks of 5,500 pounds capacity. It was his duty to dilute acid of 1.820 specific gravity to 1.240. No doubt there was considerable spray at this station due to the heat generated during dilution of the acid. Below this platform and a few feet distant is a rheostat consisting of two large sheet-lead electrodes in a tank of salt water. The plates are said to be of pure lead. While considerable gas, hydrogen, and oxygen, and spray are given off when the current passes through the saline solution, it is not believed that any chlorine is liberated, since it would tend to combine again with the sodium hydroxide given off at the opposite pole.

(c) E. A. B. made lead paste with hydrofluoric acid and powdered white lead. The officer in charge states that the heat generated on mixing causes the powdered white lead to be given off in clouds. Even traces of hydrofluoric acid in the atmosphere are very irritant to the eyes and throat, according to Bloxham (5).

(d) E. A. B. "burned" lead with the acetylene torch.

(e) E. A. B. was exposed to the vapor of carbon disulphide while engaged in the repair of the rubber battery casings.

Prior to E. A. B.'s illness there seems to have been no apparent occupational disease among the battery overhaul personnel. Therefore, presumably, it has not been deemed necessary to institute any special precautions against lead and other contaminations.

TABLE 2.—*Blood examinations of battery overhaul personnel*

Case No.	Name and rate	Age	Duration of present duty	RBC		WBC		2 days before battery charging (per cent)						RBC		WBC		5 days after start of battery charging (per cent)						RBC		WBC		2 weeks after end of battery charging (per cent)					
				Hqb	P	L	LM	T	E	B	Hqb	P	L	LM	T	E	B	Hqb	P	L	LM	T	E	B	Hqb	P	L	LM	T	E	B		
1	C. E. W., CEM...	41	3 years 4 months.	4,900,000	6,550	90	56	41	1	2	0	0	4,290,000	7,800	70	46	49	2	0	2	1	4,970,000	8,000	100	59	38	0	0	3	0			
2	J. F. M., EMlc...	26	3 years.	4,740,000	6,650	90	61	36	1	1	1	0	3,490,000	6,000	100	57	37	4	0	2	0	4,330,000	5,200	90	53	41	3	0	2	1			
3	W. N. F., EM3c...	24	2 years.	4,710,000	6,800	90	50	47	1	2	0	0	3,680,000	7,200	85	51	44	0	0	4	1	4,760,000	6,800	100	52	41	1	0	5	0			
4	M. E. O., Seale...	21	1 year 2 months.	4,460,000	7,950	70	39	58	2	0	1	0	(1)																				
5	C. F. R., F3c...	22	8 months.										4,100,000	6,000	80	59	38	0	0	3	0	5,510,000	6,500	90	58	32	7	0	3	0			
6	L. D. H., Seale...	19	4 months.										4,500,000	5,600	70	44	45	2	0	9	0	4,440,000	5,250	90	53	42	1	0	4	0			
7	M. L. R., Seale...	22	6 months.										3,490,000	8,200	85	61	37	1	0	0	1	4,490,000	5,400	100	56	40	2	1	0	1			
8	E. H. B., EMlc...	24	3 years.	4,500,000	3,150	70	2	96	2	0	0	0																					

1 Transferred.

Table 2 was compiled from complete blood counts of men on duty in the battery room. The first examinations were made during a period when no charging was being done. The second examinations were made five days after charging commenced, which is considered about the peak of the operation. The third series of blood counts were taken two weeks after a charging period.

Case 1 has been on the present detail over three years. It will be noted that there is a slight variability in erythrocyte, hemoglobin, and leucocyte estimations in the three periods. A decrease in erythrocytes and hemoglobin was found during the charging period, whereas the leucocytes increased. The differential count revealed a lymphocytosis during charging operations. Case 4 showed a lymphocytosis before charging began, but further examinations were not obtained due to this man being transferred. Cases 5, 6, and 7 were not available when the first examinations were made. During the peak of charging operations, however, case 6 had a low hemoglobin and a lymphocytosis which became normal two weeks after charging had ended. Case 8, first blood examination of E. A. B., deceased, after admission to the hospital, is added to this table to facilitate comparisons.

COMMENT

This case probably was one of agranulocytic angina, although the leucopenia was not so marked as in cases reported by others. Nevertheless, a leucopenia was present with a high relative lymphocytosis. The organism isolated from the blood culture obtained at necropsy was a streptococcus. Treatment did not influence the course of the disease. Owing to the fact that the deceased had been exposed to sulphuric-acid vapors, which cause pharyngeal irritation, a superficial industrial survey was made in order to find a possible health hazard bearing on the etiology of the condition. Blood examination showed a normal erythrocyte count and there were no abnormalities of the cells in the stained smear.

Blood examination of men on the same duty demonstrated some changes in the blood picture during active battery-charging activities, but the evidence is insufficient to conclude that the industrial phase had any bearing upon the etiology of the case reported.

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RUPTURE OF THE LONG HEAD OF THE BICEPS FLEXOR CUBITI MUSCLE

WITH REPORT OF CASES

By C. M. SHAAR, *Lieutenant, Medical Corps, United States Navy*

Rupture of the long head of the biceps flexor cubiti is probably more common than present records would indicate. The two cases described below merit reporting for two reasons. The first emphasizes the importance of early recognition of this condition and the splendid result obtained by immediate operation. The second case serves to illustrate what happens when such a condition is overlooked for years.

In 1905, W. W. Keen collected 72 cases of rupture of the biceps muscle, one of which was very similar to the first case about to be reported. The patient was operated on by DaCosta and nine months later the result was perfect. Another similar case was operated on successfully by Ludington in 1923. Alexander, in 1915, collected 84 cases, and of this group only 10 were operated on. The absence of severe pain at the time of the accident tends to minimize the seriousness of the condition, but diagnosis is not difficult if the examination is thorough.

ANATOMY

The biceps muscle forms the prominent part of the arm in front and can be made very distinct by flexing the forearm on the arm. It has no attachment to the humerus and is bordered by two grooves. The inner groove extends from the axilla to the bend of the elbow and it is the more conspicuous of the two. It corresponds to the intermuscular interval over the brachial artery, median nerve, and the basilic vein. The outer groove is shallow and runs from the elbow to the insertion of the deltoid muscle and overlies the cephalic vein (fig. 1).

The muscle received its name from having two heads. The long head arises from the upper edge of the rim of the glenoid cavity and passes through the cavity of the shoulder joint, emerging from the capsule with a synovial membrane. It passes through the bicipital groove, under the transverse humeral ligament, and descends in front of the humerus to form a fleshy belly which is united to that derived from the short head. The short head arises from the tip of the coracoid process of the scapula and passes downward, forming a separate fleshy belly which unites with that from the long head. The two bellies are connected below to a strong tendon which is inserted to the posterior portion of the tubercle of the radius. From

the tendon a strong fascia passes downward and covers the flexor group of muscles (fig. 2). The biceps is supplied by the musculocutaneous nerve.

FUNCTION

Cunningham describes the action of the muscle as follows: "The actions of the biceps are complex, in that they affect three articulations—the shoulder, humero-radial, and radio-ulnar joint. The

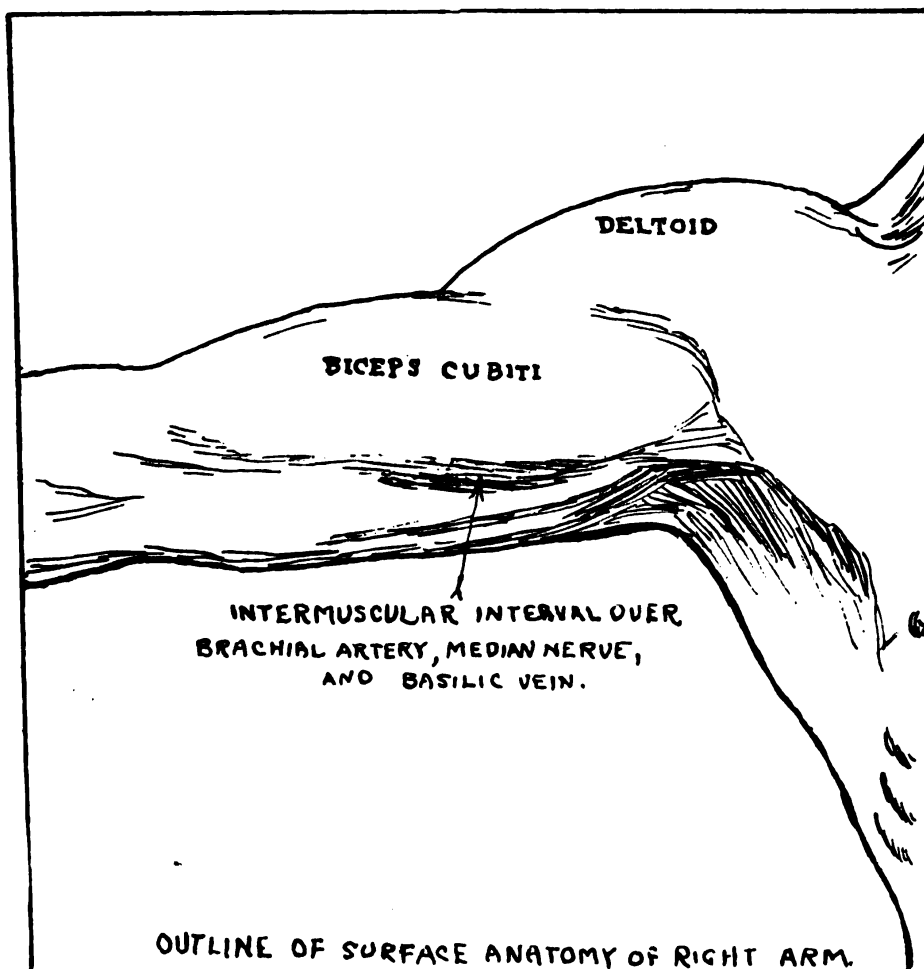


FIGURE 1

muscle raises and draws forward the humerus at the shoulder joint, it flexes the elbow joint, and it supinates the forearm. The combination of these actions results in a simple movement like that of raising the hand to the mouth." Treves states that the biceps tendon strengthens the upper part of the shoulder joint, keeps the humerus against the glenoid cavity in the various positions of the limb, and prevents the head of the bone from being pulled too closely upwards under the acromion.

ETIOLOGY AND PATHOLOGY

Rupture of a muscle or its tendon is either the result of trauma or is spontaneous. In the first instance the condition is usually the result of a violent muscular contraction. "Lawn tennis" leg, rupture of some of the fibers of the gastrocnemius either alone or with rupture of the plantaris; "rider's thigh," where the muscular fibers of the

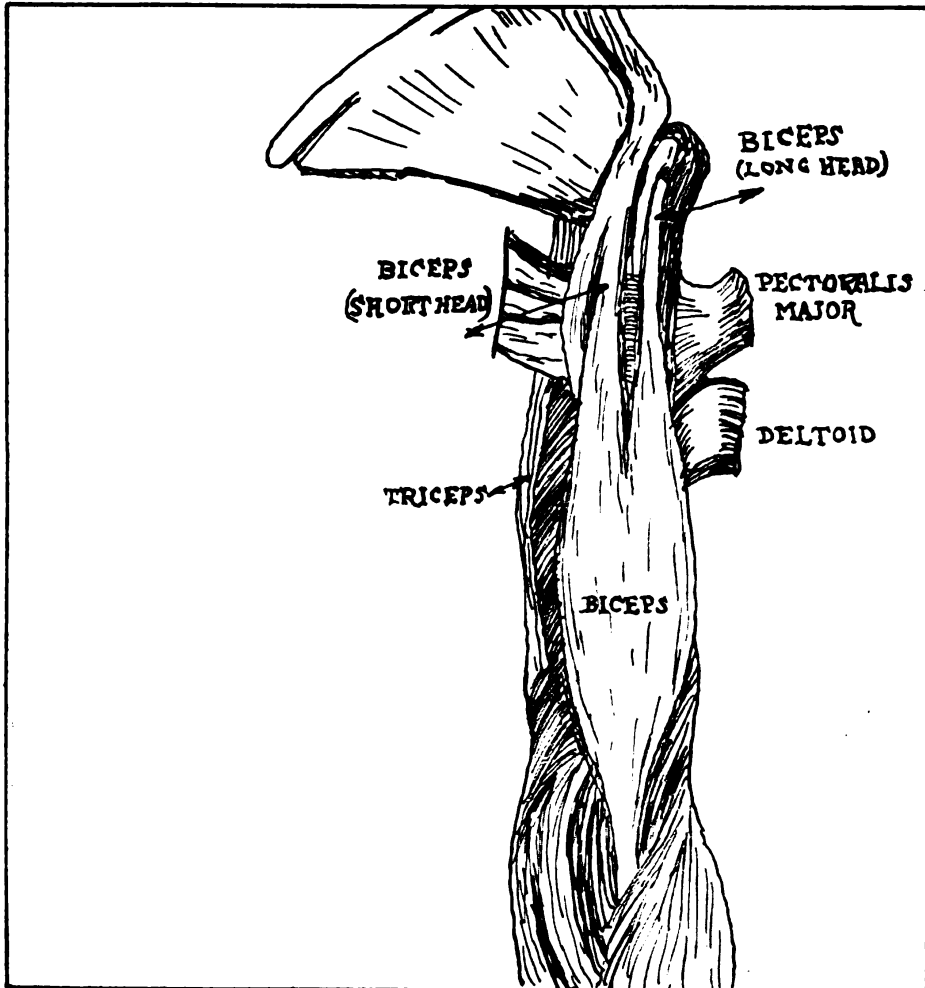


FIGURE 2

adductors of the thigh are torn to a greater or lesser degree; "drummer's paralysis," rupture of the extensor longus pollicis; and rupture of the long head of the biceps above the bicipital groove are but a few examples of such accidents. In the second class of cases, namely, spontaneous rupture, the condition is always the result of pathologic changes. The third and most common cause is a combination of a sudden muscular effort with a predisposing pathologic factor. Davis states that when a tendon ruptures it is very likely to have been

diseased. Keen agrees with this view. The commonest sites of rupture are in the quadriceps tendon, tendo Achillis, and the biceps and triceps tendons in the arm. It is much more common in men than in women. Loos's table of 66 cases shows records of only 2 women and 64 men. Predisposing causes are very important factors—atrophy, degeneration, arthritis, tuberculosis, and syphilis are frequently the underlying causes. Keen reported rupture of the long head of the biceps associated with tuberculosis of the shoulder joint and rupture of the longus pollicis with tenosynovitis. Ritschl mentions the following as predisposing causes (Keen) :

1. Inflammatory hydrops (Volkman).
2. Lipomata in the tendon-sheath (Witzel, Haumann).
3. Trophic disturbances in tabes and syringomyelia (Lowenfeld, Hofman).
4. Arthritis of the knee (Rohl).

When rupture of the long head of the biceps is above the bicipital groove it is usually the result of muscular effort alone, but when it ruptures in the groove, Borchers believes that constant chafing of the tendon by osteophytic outgrowths on the tuberosities of the humerus is responsible for the accident. Ledderhouse and Ewald both agree that exostoses of arthritis deformans first appear about the shoulder joint. Ledderhouse found arthritis deformans around the shoulder joint in 50 per cent of cases in advanced age.

DIAGNOSIS

When the long head of the biceps is ruptured from a sudden muscular effort or by lifting a heavy weight, a snap may be felt and sometimes heard. This may or may not be accompanied by sharp pain and there is always an immediate but incomplete loss of function of the muscle. The fleshy belly of the biceps is far more often injured than the tendon. When such is the condition a gap is found between the ruptured portions and each portion shows a lump. In the rupture of the tendon only one lump is present. If the rupture is through the tendon of insertion the muscle is pulled upward and the muscular belly is nearer the shoulder, but if the rupture is of the long head the muscular lump is much nearer to the elbow and there is a definite depression above it. When the long head of the biceps is ruptured, in addition to the general weakening of the arm and the appearance of the muscle, the head of the humerus is drawn forward and upward. Huter's sign is usually present. (Flexion with the forearm supinated is much less powerful than flexion with the forearm pronated.)

Rupture of the long head of the biceps should be differentiated from dislocation of the tendon, which results from violent wrenches

of the limb causing rupture of the transverse ligament and the displacement of the tendon to one or the other side of the bicipital groove. When this condition occurs the displacement is usually to the inner side, and the outer displacement is seldom seen because the insertion of the pectoralis major muscle prevents the biceps tendon from being dislocated to the outer side.

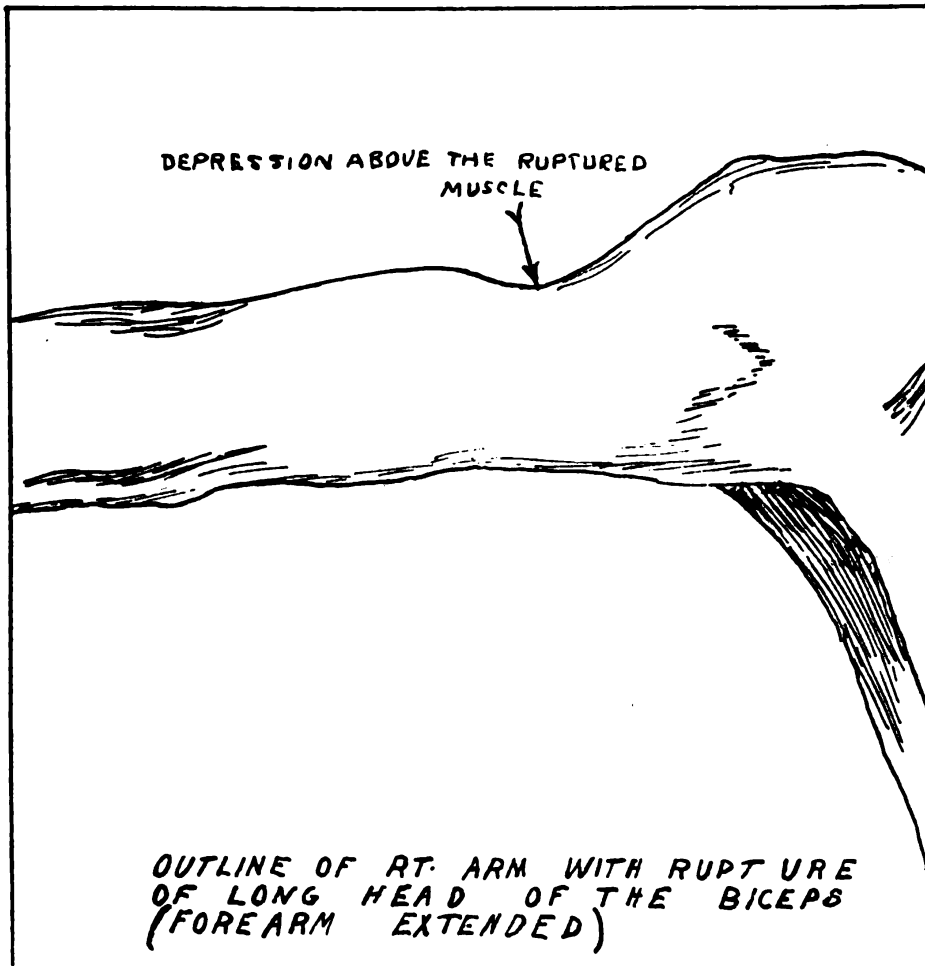


FIGURE 3

CASE REPORT

Case. 1.—M. G., age 67 years, Spanish, printer by occupation, entered hospital complaining of sudden loss of power in right arm. Patient stated that the accident occurred a few hours prior to admission. While carrying a heavy piece of lead (weight about 55 pounds) with the right hand he felt "something become loose and unreeled in his right shoulder." The arm became weak and he dropped the piece of lead. This came on with practically no pain.

Past history.—Gonorrhea in young adult life, malaria at 25 years of age, and smallpox at 30. There is no history of trauma, or of muscle or joint pains. Patient has not smoked or drunk for the last 10 years. Prior to this period he used alcohol and tobacco in moderation.

Examination.—Well developed; powerful muscular type. General examination does not show any abnormality except in right upper extremity. The right shoulder and arm did not show any swelling, discoloration, points of tenderness, or crepitus. The humerus appears to pass somewhat forward and upward and while the patient is able to flex the forearm on the arm he does it slowly and incompletely. Abduction, circumduction, and backward extension are also limited. When the forearm is flexed the muscular belly appears much nearer the elbow than that on the left side and the flexion with the forearm supinated is much less powerful than flexion with the forearm

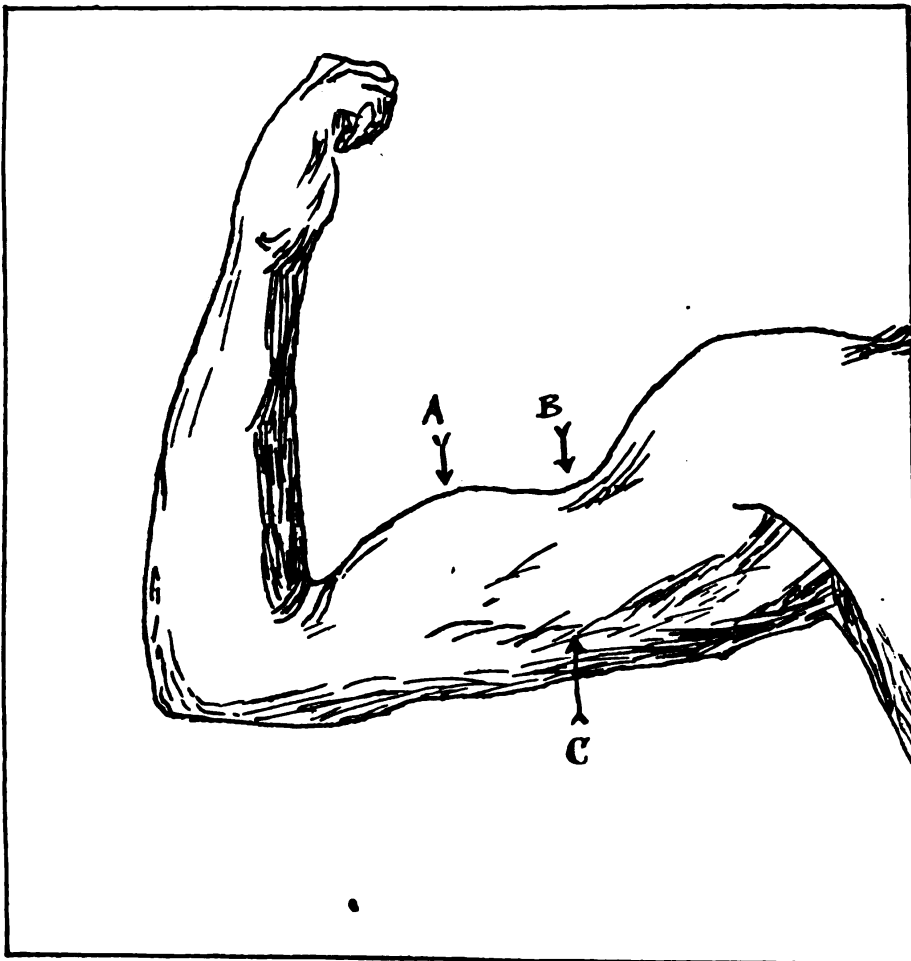


FIGURE 4

pronated (Huter's sign). The long head of the biceps cannot be palpated. (figs. 3 and 4). Blood pressure: Systolic, 150; diastolic, 100. Urine, negative, Wassermann test, negative. Blood count, normal. X-ray examination of right shoulder did not show any evidence of abnormality. On December 14, 1922, operation was performed under local anesthesia (novocaine 0.5 per cent). A 2-inch incision was made over the anterior surface, in the upper third of the right arm, parallel to the tendon of the long head. Exploration revealed rupture of the long head of the biceps with a small piece of periosteum torn from the glenoid cavity. There was no hemorrhage or evidence of injury to any

other structure in that region. The short head of the biceps was located and a small opening was made through the muscular part near the tendinous portion and the long tendon was passed through this opening from below upward. A portion of the upper end of the long tendon was cut away and the stump was fastened to the tendinous portion of the short head, firmly but without tension. The wound was closed without drainage.

Postoperative treatment consisted of immobilization for 16 days. This was followed by passive motion and massage daily. Twenty-three days after operation the patient was discharged from the hospital without any dressings.

Five months after operation he was back on his job doing the same type of work as prior to accident. The patient stated that he was able to use his right arm as well as before the injury without the slightest pain or limitation of motion.

The result was most satisfactory.

Case 2.—W. C. W., chief pay clerk, United States Navy, 47 years old.

Chief complaint.—Weakness in right arm.

History.—About four years ago while pulling a box (weight, 150 pounds) off a truck he felt "something get loose in his arm." There was slight soreness like that of a bruise but no sharp pain. The arm felt weak and dropped to his side. He was examined shortly after the accident and a liniment was prescribed. A few days later he attempted to crank his automobile but was unable to do so because of the weakness and soreness in his right arm. The patient noticed a marked depression in his arm above the biceps that he thought did not exist before. He was examined again by a physician who told him there was nothing radically wrong and to use more liniment. Since that time repeated examinations have been made by various physicians, also by medical boards for annual physical examination, and apparently the condition has been overlooked. The first one to notice the abnormality and asymmetry in the right arm was Doctor Hernandez, who referred the case to the surgical service aboard the U. S. S. *Mercy*. Past history is unimportant and has no bearing on clinical history of the case.

Examination.—Patient is of the hypersthenic type, with powerful muscular development. The general physical examination does not show any evidence of abnormality except in the right arm. There are no points of tenderness over shoulder or arm, Huter's sign is absent, and flexion of the forearm on the arm is decidedly less powerful than that of the left arm. The muscles of the right forearm are well developed and normal in function. The tendon of the long head could not be palpated, neither could its muscular belly, even when the forearm was flexed on the arm. This muscular portion of the biceps has apparently atrophied (injury over four years ago). The short head of the biceps has undergone hypertrophy, and when the muscle is contracted it stands out in a conspicuous manner. The shape and outline of the right arm differs considerably from that of the left and the two grooves that border a normal biceps are obliterated and displaced. Flexion of the forearm is not powerful and function has been partially impaired (fig. 5). This condition being of four years duration the patient was advised of the uncertainty of operative results.

CONCLUSION

1. Rupture of the long head of the biceps in both cases was the result of a violent muscular contraction, with no demonstrable pathologic condition in the tendon or shoulder joint. However we have no conclusive evidence that such condition did not exist.

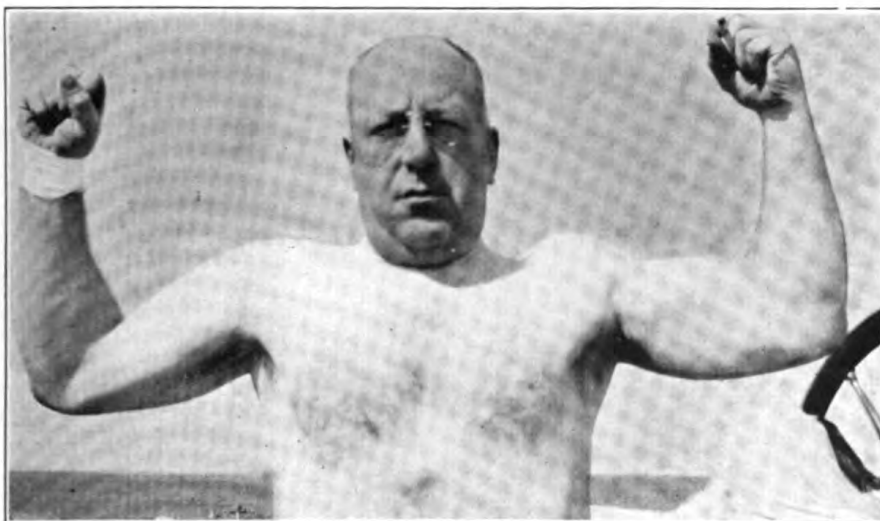


FIG. 5.—RUPTURE OF LONG HEAD OF BICEPS AND HYPERTROPHY OF SHORT HEAD (RIGHT ARM)

124

6
15
101
110
1182
117
111

109.111
17.9
10.5
10.5
10.5

10.5
10.5

2. Rupture of the long tendon above the bicipital groove, as shown in the first case, indicates that a violent muscular effort alone was the cause of the injury. If the tendon was ruptured in the bicipital groove then constant chafing of the tendon by osteophytic outgrowths on the tuberosities of the humerus or some other pathological condition would have been the underlying cause. The tendon appeared to be normal and its rupture with a piece of periosteum torn from the rim of the glenoid cavity might be called a fracture of the periosteum rather than a rupture of the tendon.

3. Pain was practically absent in both cases and the weakness and loss of power in flexing the forearm was by far the most conspicuous symptom.

4. The result of an immediate operation in the first case was excellent. In the second case, with a rupture of over four years duration, operation was not urged as the result would be extremely doubtful. The muscular belly of the long head had no doubt atrophied and fibrosed and the short head had hypertrophied sufficiently to carry on the function in a fair manner, although far from being very satisfactory.

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CHOKED DISK

ITS IMPORTANCE AS AN AID IN DIAGNOSIS

WITH REPORT OF TWO CASES

By A. H. CECHA, Lieutenant, Medical Corps, United States Navy

Undoubtedly the most important ocular sign bearing upon a systemic or cranial disease for aid in diagnosis is a choked disk. Although many pathological signs appear in the fundus of the eye which have characteristic markings corresponding to the particular constitutional disease with which they are associated, none appears so early or so frequently as a papilledema, or so-called choked disk. It is seldom absent in diseases causing intracranial pressure of what-

ever origin and is often present at the onset of a disease when symptoms are indefinite or so mild that one does not realize the seriousness of the complaints. The examination of the fundus of each eye is of such importance that it should be a routine measure in a complete physical examination dealing with obscure and ill-defined symptoms. Hence, the ophthalmoscope becomes as important an instrument as the stethoscope as an aid in diagnosis, and much more reliable, because interpretation of signs by inspection is more exact than by auscultation.

Intraocular neuritis may be due either to an inflammatory process, local or general, within the cranium, or to a congestive condition in the cranial vault; the latter condition accounts for the optic swelling known as papilledema, for here we have a marked intracranial pressure which seems to be the determining factor in causing the edema. Both conditions may influence the pathology at the same time.

The diseases in which papillitis appears may have their pathology limited to the brain and its appendages or may involve the entire system with only a local manifestation. It is in the former affections, the so-called focal affections, that involvement of the optic nerve is the most common and where an ophthalmoscopic examination can early clear up a puzzling complaint. Among focal involvements of the brain, new growths are of first importance in causing the neuritis; other conditions are emboli or thrombi of the venous sinuses, aneurysms, cerebral hemorrhages, abscesses and cysts, although in these affections this sign is not so constant as when a neoplasm is present, for a prolonged intracranial pressure, even though slight, is necessary to cause an edema of the optic nerve head. Other causes of a papillitis are focal infections, such as of the teeth, tonsils, and nasal accessory sinuses; metabolic disorders, when accompanied by anemia; acute febrile infections and pathological changes, either inflammations or new growths, within the eyeball itself or in the orbit. A transient papillitis will appear after ligation of an internal jugular vein whenever it is necessary in an infective thrombus of the lateral sinus complicating a mastoiditis. Among the diffuse affections, acute or chronic meningitis and hydrocephalus show an optic neuritis.

Among the constitutional diseases in which papillitis occurs may be mentioned tuberculosis and syphilis; the latter is particularly important on account of its frequency and rapid response to specific treatment.

There are two types of papillitis recognized by the ophthalmoscope corresponding to the difference in their pathology, namely inflammatory and congestive. The ophthalmoscopic views are different and show the distinctive markings in each type, especially when the condition has existed long enough to produce the advanced changes. In

a congestive papillitis the optic disk is sharply defined and markedly raised above the surrounding retina; the arteries appear constricted, while the veins are greatly dilated and tortuous. Furthermore, as the veins cross the edge of the swollen papilla they appear interrupted. With the direct image the degree of swelling can be computed by the difference in the refraction between it and the retina. On the other hand, in an inflammatory neuritis the changes in the papilla are less marked, the chief changes being the apparent increase in diameter of the disk, which is due to the inflammatory infiltration extending into the surrounding retina, and the cloudiness and foggy appearance of the papilla produced by the exudation. One does not see much change in the size, shape, or course of the blood vessels in this latter type nor does the papilla project far beyond the retina.

The evolution of choked disk can be readily understood by a study of the anatomy of the parts involved and the physical nature of the changes that occur. As the cranium is a rigid, unyielding cavity the cerebral fluid, whenever there is an increased pressure, has two avenues of escape; one into the spinal subdural space and the other into the optic nerve. In the optic nerve the cerebral fluid distends the lymphatic spaces, causing lymph stasis and swelling of the optic nerve. As the lamina cribrosa, through which the optic nerve passes, firmly constricts the nerve the optic vein is compressed, while the artery, with its thicker wall and higher blood pressure, remains unaffected so that the blood which flows into the eyeball is unable to return and a marked mushroomlike swelling results. As there is no inflammation the papilla is sharply outlined and demarked from the retina. In an inflammatory neuritis there is a change in the nerve fibers as the process causes a cellular exudation and an increase in the number of nuclei. In both types of neuritis if abnormal conditions persist, connective tissue forms which destroys the nerve fibers and produces optic atrophy.

CASE REPORTS

Case 1.—A. W., sergeant, United States Marine Corps; age, 40. Admitted to the Marine Base Hospital, Santo Domingo City, Santo Domingo, October 5, 1922, from marine outpost in the interior of the island, with diagnosis undetermined.

Family history.—No importance.

Past history.—Until two years ago his health had been very good. For more than a year he had not been feeling well and had been admitted to the sick list several times with diagnosis of intestinal fermentation. His chief complaints at that time were anorexia, intermittent headache, and vertigo. His health record showed that he was subject to spells of depression and general malaise. None of the symptoms were evidently marked or persistent, for he was returned to duty but was readmitted later with the same symptoms

increased. There was no history of malaria, venereal diseases, or other serious illness.

Present history.—Chief complaints on admission to hospital were general headache, vertigo, anorexia, malaise, and, in particular, a perverted sense of smell and taste. Patient stated that any odor, even of fresh flowers, was unpleasant to him so that at times he would stagger and almost faint. His food had no taste to it, sweet and sour foods seeming alike. He had no symptoms referable to the respiratory, genitourinary, or cardiovascular system. No evidence of intestinal disorder, either constipation or diarrhea, was present.

PHYSICAL EXAMINATION

Patient appeared well nourished and without any external evidence of a serious illness.

Temperature and pulse were normal.

Lungs.—Normal.

Heart.—Normal; blood pressure, 128/75.

Abdomen.—Normal.

Nervous system.—Pupils were equal, regular, and reacted to light and in accommodation; superficial and deep reflexes were normal; Babsinski sign absent; Romberg sign positive; Kernig's sign absent; incoordination tests were slowly performed and ataxia was present.

Speech defects.—There were no speech defects noted in ordinary conversation.

Ophthalmoscopic examination.—Advanced stage of papilledema in each fundus, more pronounced in the right eye.

LABORATORY EXAMINATION

Urine.—Normal.

Blood Wasserman test.—Negative.

Spinal fluid.—Fluid found clear and under slight pressure. No other examination made.

Blood examination.—Normal; no malarial parasites found.

Course of disease.—Patient was placed upon increasing doses of sodium iodide with no beneficial effect. His symptoms gradually became worse and towards the end of his illness he went into coma, dying four weeks from the time of admission to the hospital.

NECROPSY

The calvarium was removed and the dura exposed. Upon removal of the brain a soft tumor stained with blood, about the size of a walnut, was found in the right frontal lobe, laterally and 1 inch in front of the central fissure. The pathological specimen was sent to the Naval Medical School, Washington, D. C., where a diagnosis of glioma of the cerebrum was made.

Case 2.—H. C. S., first sergeant, United States Marine Corps. Admitted to the Naval Hospital, Portsmouth, N. H., September 3, 1927, with diagnosis undetermined (syphilis).

Chief complaints upon admission were frontal and occipital headaches, defective vision, failing memory, and general lassitude.

Past history.—Patient strongly denied a previous syphilitic infection, nevertheless a diagnosis of syphilis appeared in his health record. This was made in Haiti about a year prior to admission to the Portsmouth Naval Hospital, and he had been transferred to the United States as a result of a medical survey with recommendation for antisyphilitic treatment. His health record

showed a negative blood Wassermann and absence of lesions or other positive signs characteristic of syphilis. He was transferred from the receiving ship, New York, to the navy yard, Portsmouth, N. H., where he received his arsphenamine injections. Twice, following intravenous injections of salvarsan, he developed a temporary hemiparesis involving the left side of face and extremities; seizure appeared the day following the injection of salvarsan and lasted about 30 minutes.

Present history.—Complained of continuous headaches over eyebrows with occasional dull pains over occiput; duration, two months. No vertigo, nausea, or vomiting present. Stated his vision was not so good as formerly. Appetite was good; was not constipated; slept well. His mental processes were retarded, but he answered all questions intelligently. Physically he appeared slow acting.

PHYSICAL EXAMINATION

General appearance.—Patient appeared well nourished and robust; height, 67½ inches; weight, 166 pounds.

Heart and lungs.—Normal. Blood pressure, 114/75.

Eyes.—Vision, O. D. 20/20, O. S. 20/20; marked concentric contraction of the fields of vision in each eye; pupils reacted to light and in accommodation; no errors of refraction. Ophthalmoscopic examination showed advanced stage of choked disk of equal prominence in each eye.

Nervous system.—No alteration in the superficial or deep reflexes; no sensory changes in the cutaneous areas.

LABORATORY EXAMINATIONS

Blood examinations.—Red cells, 4,690,000; hemoglobin, 85 per cent. White cells, total 9,750; differential count, polymorphnuclear 73 per cent, lymphocytes 26 per cent, mononuclear 1 per cent. Kahn precipitation test (blood serum) repeatedly negative.

Spinal fluid.—Clear and under great pressure; Kahn test, plus 2; globulin increase marked; cells per cubic millimeter, 554 polymorphnuclear leucocytes (not lymphocytes as is often stated in textbooks); gold colloidal test performed at the Naval Medical School showed a leucic curve, 4433221000.

COURSE OF DISEASE

The patient was placed on a course of potassium iodide in increasing doses and mercury by inunction. His condition did not improve at once as shown by development of vertigo, nausea, vomiting, and an increase in the papilloedematous swellings. After the dose of potassium iodide reached 90 grains per day the patient's headache and vertigo entirely disappeared and on December 5, 1927, the optic disks were entirely normal. Likewise the patient became more active mentally and physically. On this date the spinal fluid was still under moderate pressure but the pressure was much less than at the first puncture and the cell count showed 305 leucocytes per cubic millimeter. The Kahn test of the spinal fluid was plus 4 and of the blood serum, negative. The patient continued to feel well and before he was discharged from the hospital was placed upon further treatment with arsphenamine.

AMEBIC ABSCESS OF THE LIVER RUPTURING THROUGH THE LUNGS**REPORT OF AN UNUSUAL CASE**

By OSCAR DAVIS, Lieutenant Commander, Medical Corps, United States Navy

The patient, E. J. H., a gunners' mate 1c, United States Navy, was at the time he first noticed symptoms, attached to one of the smaller gunboats on the upper Yangtze River. The patient dates the inception of his trouble back to December, 1927, when, after a series of parties where alcohol was taken rather freely, he noticed that he began to lose weight (best weight 151 pounds); also that he felt chilly in the afternoons, and later in the evenings feverish, to be followed at night by profuse sweating and relief from his symptoms. A cough, which he had for about two years previously, became more pronounced, and he began to expectorate freely. There was no history of any previous intestinal disorder. On March 12, 1928, he was admitted to the sick list with a tentative diagnosis of tuberculosis, chronic pulmonary, and presented at that time the following positive physical findings: Weight, 115 pounds; temperature, 99; pulse, 75; respiration, 18. Marked alopecia of entire body. Blood pressure, 110-70. Lungs normal to percussion and palpation, but showed a few moist râles in the right apex after coughing. Liver two fingers' breadth below the costal margin in the midclavicular line. From the above date until March 24, 1928, when the patient was transferred to the International Hospital, Hankow, on his arrival from upriver, his symptoms advanced rather rapidly, showing progressive emaciation, pallor of skin, temperature ranging from 98 to 103, with drenching night sweats, gradual enlargement of the liver with some epigastric tenderness, mucopurulent expectoration, and signs of consolidation in the right lung. The diagnosis was changed to pneumonia, broncho. Urine was negative, and blood showed red blood corpuscles 4,000,000; white blood corpuscles, 20,000, with differential count of polys., 65 per cent; lymphocytes, 32 per cent; and mononuclears, 3 per cent. No tubercle bacilli were found in the sputum on repeated examinations.

On admission to the hospital and to the writer's care, with history as above, and no personal history of syphilis or tuberculosis in his family, physical findings were as follows: Patient very much emaciated; almost complete alopecia; skin and conjunctiva slightly jaundiced; mucous membranes slightly cyanotic; marked dyspnea; pulse rapid, with poor volume; lower half of right chest bulging, with widened intercostal spaces and restriction of respiratory excursions; left chest, clear to percussion, except for a triangular area of dullness at the base, adjoining the vertebral column; breath and voice sounds, exaggerated throughout entire left chest. Right chest, resonant anteriorly to the fourth interspace; right apex, resonant posteriorly. An area of dullness was found at the angle of the right scapula, and flatness at the right base, mid-scapular line. Tubular breath sounds at angle of scapula and at base posteriorly, and numerous moist râles throughout. Voice sounds were clearly transmitted in above two areas. Heart normal as to size and position; rate rapid (120). Abdomen slightly distended, marked tenderness in epigastric region, liver extending four fingers' breadth below costal margin, but not tender. No ascites. Abdomen otherwise negative. Genitalia and extremities negative. Blood pressure, 95-68.

Patient became very dyspneic the day of admission to the hospital. Digitalis was pushed in view of the low blood pressure, which, in the absence of previous intestinal history, was thought to be the cause of the enlarged liver. The

character of the sputum changed during the night, rapidly becoming thick, tenacious, and reddish brown in color, and was expectorated in large quantities. The size of the liver, as noted the following day, was noticeably decreased, thus marking definitely the time of actual rupture of the abscess cavity into the lung tissue. The broncho-pneumonia existing at the time of admission to the hospital, and which later findings proved to be secondary to the abscess of the liver, was of sufficient extent and gravity to mask the primary disease, the infection having advanced through the liver wall and the diaphragm to the lung by continuity of tissue, forming adhesions and allowing the abscess to be directly evacuated through the lung. As soon as the patient's condition warranted moving, there being no portable X-ray equipment available, an X-ray plate of the chest was made. This showed: Left lung, clear throughout; right apex, clear; marked infiltration at angle of right scapula and at right base. Shadow of diaphragm, regular up to a distance of 6 centimeters from the right lateral chest wall, where it bulged upward with marked, serrated, crater-like formation into the pleural cavity. The size of the liver began to decrease following the change in the character of the sputum on the second day in the hospital.

Repeated sputum examinations failed to show tubercle bacilli. No amebæ were demonstrable in the sputum at any time, nor were any found in the stools on repeated examinations. Laboratory findings on admission were as follows: Urine, negative. Blood smear negative for malarial parasites. Red blood cells, 3,800,000; white blood cells, 20,000, differential count, polys., 70 per cent; lymphocytes, 25 per cent; mononuclears, 3 per cent; eosinophiles, 2 per cent.

The patient ran a daily afternoon temperature of 103°, falling to 97° in the morning, and had a drenching sweat during the night. Emetine, hypodermatically, was begun April 3, after X-ray examination, and the patient's temperature immediately came down to normal and remained normal until the course of emetine was completed, when it again rose to 101°, with nightly remissions to normal or subnormal. This fever, however, stopped as soon as the second course of emetine was begun and remained normal permanently. One grain of emetine hydrochloride was given daily for a period of 10 days, followed by a rest period of 10 days. Exploratory punctures were made on April 3, in the seventh interspace, anterior axillary line, but no abscess cavity could be located. The character of the sputum changed soon after beginning emetine and in a few days became mucopurulent and much diminished in quantity, and the patient began to show marked improvement generally and was quite comfortable. A third course of emetine, hypodermatically, combined with Yatren 205, orally, was completed May 26. At this time the patient had gained 20 pounds in weight, the lungs were clear except for some residual infiltration at the angle of the scapula and at the base, the liver was just palpable below the costal margin, but some bulging of the lower right chest wall persisted and some edema of his ankles would appear after he had walked for a short period of time. His urine, however, was negative and his blood pressure 100-70. He was transferred to the United States Naval Hospital, Canacao, P. I., May 28, convalescent, for further treatment and disposition.

The above case is reported as being unusual, the statistical data available showing that 10 to 12 per cent of untreated amebic abscesses of the liver evacuate spontaneously through the lung, but that the percentage of recovery in such cases is very low, due, as a rule, to secondary infection of the abscess cavity from the lung, with persistent drainage, and because of the fact that there was no history

of previous intestinal infection, which was confusing in arriving at a diagnosis. It also illustrates the prompt response of this condition to emetine therapy, when drainage is established.

COMPOUND FRACTURE OF MAXILLA

By M. W. MANGOLD, Lieutenant Commander, Dental Corps, United States Navy

Due to the extensive protection afforded the superior maxillary bone, by such bones of the face as the malar, nasal, frontal, and mandible, fractures of the upper jaw are extremely rare. When such an injury occurs, it is the result of extreme violence. These injuries are always serious and often prove fatal, either from shock, hemorrhage, direct injury to the brain, or from secondary complications.

The following case is most unusual in that the injury resulted in a compound fracture through the maxilla, along the median line, separating the maxillary bones sufficiently to cause a fissure 5 millimeters wide through the hard and soft palate directly into the nasal cavity, without apparent injury to any of the adjacent bones of the face except a small fracture of the nasal bone.

CASE REPORT

The patient, an apprentice seaman, age 18, weight 134 pounds, was admitted to the United States Naval Hospital, Great Lakes, Ill., February 21, 1927, with the history of falling out of his hammock and striking on his face on the concrete floor about 6 inches.

The patient presented a swollen, discolored face; eyes partly closed; abrasion over the nose; hemorrhage from nose and mouth; examination of the mouth revealed a lacerated wound completely through the palatal mucosa, along the median line, extending from the central incisor teeth to the center of the soft palate; and a fracture through the maxilla and the horizontal plate of the palate bone, leaving a fissure 5 millimeters wide and about 35 millimeters long, opening directly into the nasal cavity. The entire right maxillary bone was easily movable; the dental arch was so distended that the posterior teeth were out of normal occlusion.

The nasal fracture was reduced, hemorrhage controlled, and ice caps applied to the face; but, on account of the patient's general condition, no attempt was made at this time to reduce the maxillary fracture.

The X ray (fig. 1) showed the maxillary bone to be fractured and separated along the median line, and a horizontal line of fracture through the right canine fossa under the zygoma, extending distally to the pterygopalatine fossa. (Note separation between central incisor teeth.)

Two days later the patient improved sufficiently to permit the reduction of the fractures and the closing of the hard and soft palate. Figure 2 shows the method used to reduce the fracture. Two pieces of fracture arch wire about 2 inches long were adjusted to the upper teeth from the laterals distal to the second molars; suitable cross wires were adjusted to the arch wire,



FIG. 1.—X-RAY PICTURE OF FRACTURE OF MAXILLA. NOTE SEPARATION BETWEEN CENTRAL INCISOR TEETH. (MANGOLD)



FIG. 2.—METHOD USED TO REDUCE FRACTURE OF MAXILLA. (MANGOLD)

passed between the teeth and across the palate, and fastened to the opposite arch wire. The distal cross wire in Figure 3 is covered with small rubber tubing to protect the tongue.

The fissure was then thoroughly examined for any foreign bodies or detached fragments of bone; the edges were freshened, cleansed, and irrigated. In order to bring the edges of the wound together it was necessary to make two long parallel incisions about one-half inch on each side of the wound, and with a curved periostotome elevate and loosen the mucosa. This permitted the edges of the wound to be easily brought together and sutured. The cross wires were tightened a little each day until the central incisors were brought together and the posterior teeth were in proper occlusion.

The patient was put on special soft diet, and the entire mouth and appliances thoroughly cleansed and irrigated twice daily. Patient was up and about on the tenth day; mouth irrigations continued. The hard and soft palates were completely closed; sutures removed. At the end of the sixth week union had taken place. The appliance was removed and patient discharged from further treatment.

ADDISON'S DISEASE

REPORT OF CASE

By W. S. SARGENT, Lieutenant, and C. E. FITZGERALD, Lieutenant (Junior Grade), Medical Corps, United States Navy

Addison's disease is characterized by marked asthenia, bronze color changes in the skin, pain, and gastrointestinal troubles. Asthenia is usually the first symptom. Effort of slightest degree is exhausting.

Pain in the epigastrium, lumbar region, joints, or hypochondrium is common.

Anorexia, vomiting, and diarrhea appear sooner or later, and are very troublesome.

Melanoderma is likely to be one of the last symptoms to appear. It is practically always present, except in the so-called defaced cases. It is slow in its course, and sudden death is not common.

Addison's disease is difficult to diagnose before the appearance of the melanoderma. The disease is more often found in males than females, and between the ages of 25 and 50. Tuberculosis is probably the commonest cause, although lues, hemorrhage in the adrenals, inflammation of the adrenals, and trauma may be causative. Rowntree emphasizes influenza and pneumonia as causative agents.

The treatment is unsatisfactory, and, while some few cases may be helped temporarily, the outlook is always very grave. Epinephrin can be given hypodermically and by rectum, accompanied by whole gland or suprarenal cortex by mouth to the point of tolerance. Rowntree points out the need of determining the tolerance in each individual case.

CASE REPORT

B. W. G. (Veterans' Bureau patient); age, 30 years. Admitted April 20, 1928, as with Addison's disease.

Chief complaints.—Marked weakness and ready fatigability following slight exertion; diarrhea, nausea, and vomiting; tenderness in right testicle and slight discharge from an old sinus tract on right side of scrotum; severe frontal headaches; nervous instability; and brownish discoloration of face, neck, hands, and forearms.

Family history.—Mother, age, 71 years, died in 1926 of acute pulmonary tuberculosis. Father, age, 71 years, died in 1923 following a prolonged illness of an unknown cause. One sister, age, 43 years, now suffering from active pulmonary tuberculosis.

Past history.—Pertussis in childhood. Diphtheria in 1910. Chronic nasal catarrh for past 15 years. Epididymectomy, bilateral, for tuberculosis of epididymi in 1921. Venereal disease denied. Has never had influenza.

Present illness.—Patient was well until 1919, when he received a blow to the scrotum, followed one year later by pain and swelling of testicles which did not recede after lancing and local treatment. Condition diagnosed as tuberculosis of the epididymi in 1921 and an epididymectomy, bilateral, was performed. Several discharging sinuses developed, for which the patient has received hospitalization and out-patient treatment at varying intervals. Generalized weakness and ready fatigability started insidiously in December, 1925, and have grown progressively worse, although he kept at his work until April, 1928. For the past three months this condition has grown rapidly worse until the slightest exertion is now followed by extreme fatigue. During this time, he has noticed that his face and hands have become "tanned," although he has not been exposed to sunlight. One week prior to his admission, the patient was seized with violent colicky pains in the epigastrium accompanied by nausea and vomiting and followed by diarrhea. The gastric irritability and diarrhea persisted and it was for this that he sought medical aid. Attacks of vertigo and severe frontal headaches have occurred frequently during the past two months. He also complains of nervous instability and stiffness of joints, and describes several symptoms suggestive of transient vasomotor disturbances. (The drawing of blood for a Kahn test was followed by profuse sweating and vomiting.) He gave no history suggestive of status lymphaticus in early childhood. Has maintained his average weight throughout. History by systems essentially negative except for nocturia one to two times for past two months and a dull pain in region of the bladder when the latter becomes distended.

Physical examination.—A white male, about 30 years old, lying in bed, restless and quite weak. Nutrition and development good. Skin of face, neck, hands, and forearms have a muddy, brownish hue. Mentally alert and cooperative. Height, 70 inches; weight, 163 pounds. Temperature, 98.6; pulse, 88; respirations, 26. Blood pressure: Systolic, 90; diastolic, 60. Considerable dental repair work. Mucous surfaces of normal color.

Lungs, clear. Heart tones, very faint. No cardiac enlargement, irregularities, or murmurs.

Abdomen negative except for soreness and tenderness of muscles following strain of repeated vomiting.

Both testicles smaller than normal and quite tender. Old epididymectomy scars and scars of several healed sinuses in proximity of symphysis pubis. Slight sero-sanguineous discharge from old sinus near upper pole of right testicle.

Skin is soft and of a fine texture. Pigmented as described above. No discoloration about axillary folds, genitals, or of buccal mucosa. Sergents' sign negative. Tactile sensations normal.

Neurological examination.—Negative.

Laboratory examination.—Red blood cells, 5,560,000; white cells, 7,600; hemoglobin, 86 per cent; neutrophils, 53 per cent; lymphocytes, 44 per cent; eosinophiles, 3 per cent. Kahn, negative. Blood sugar, 95 milligrams per 100 cubic centimeters. Blood calcium, 10.6 milligrams per 100 cubic centimeters.

Urine.—8 to 10 leucocytes per field. Otherwise negative.

Electrocardiogram.—Moderate sinus arrhythmia. The waves are low throughout, indicating poor cardiac tone.

X-ray examination.—(Chest stereo.)—No evidence of enlarged thymus. No evidence of active tuberculosis. Lung markings are increased giving evidence of numerous past infections.

No evidence of urinary calculus.

Basal metabolic rate, minus 4 per cent.

Dynamometer readings.—Right hand, 40-40-38-35-30. Left hand, 40-40-36-32-28-24.

Clinical course.—The patient was given adrenalin subcutaneously and per rectum, thyroid extract, and suprarenal extract. Symptomatic treatment was given for gastro-intestinal disturbances, and, on one occasion, strychnine was administered to combat collapse following removal to a wheel chair while his bed linens were being changed.

Despite all therapy, his condition grew rapidly worse. The blood pressure dropped to systolic 74, diastolic zero. Vomiting became incessant and asthenia extreme. Pigmentation deepened and spread to involve the axillary folds, crural regions, and the muco-cutaneous junction about the mouth. There were no visible nutritional changes and his mind was clear until the end. Two days preceding death, he complained bitterly of lumbar pains. He became highly nervous, apprehensive, and temperamental.

On May 8, 1928, 18 days after admission, he went into a sudden collapse and died shortly afterward.

Autopsy findings.—The body has been embalmed; it is that of a well-nourished male adult. There is a brownish-black pigmentation of the skin of the face, neck, hands, and external genitalia.

Thorax.—Lungs are normal, no evidence of tuberculosis present or past. The heart muscle is pale and flabby.

Abdomen.—No free fluid. All lymph nodes are enlarged. The adrenals are about four times normal size and the cut surface shows no normal architecture. They are quite fibrous and contain many soft yellow areas some of which are surrounded by a definite fibrous band. One contained caseous material. The kidneys are normal, as are the ureters. The seminal vesicles contain several fibrous areas with caseous centers. The bladder and prostate are normal. Both epididymi have been removed.

Sections of adrenals and seminal vesicles show tuberculosis.

Pathologic diagnosis.—1. Addison's disease—tuberculosis of the adrenals.
2. Tuberculosis of the seminal vesicles.

COMMENT

The case of Addison's disease reported offers very little that is atypical. An increased sugar tolerance, disturbance in nutrition, and mental impairment were lacking. The family history of pul-

monary tuberculosis is interesting and the patient's previous history of genital tuberculosis soon suggests itself as the primary source of infection in considering the diagnosis. The insidious onset featured by progressing asthenia, and, late in the disease, pigmentation, gastrointestinal irritability, and, finally, collapse terminating in death, all go to make up the classic picture of this rare symptom complex. The duration of 28 months is longer than the average of $16\frac{1}{2}$ months reported in Rowntree's series.

ENDARTERITIS OF FEET WITH GANGRENE

By L. H. WILLIAMS, Lieutenant Commander, Medical Corps, United States Navy

CASE REPORT

F. C., a young Haitian male of 22 years, was brought to the Justinien Hospital, Cape Haitien, January 21, 1928, with the complaint of inability to stand on his feet. He stated that his disability began some 17 days prior to admission with a sensation of cold in his toes, which quickly spread over both feet. His friends had persuaded him to put his feet in hot water to warm them. This he did and ascribed the appearance of his feet as seen in the illustration to the effects of the hot water. He stated that at no time had he felt any pain in his legs or feet. Dry gangrene was well advanced in both feet on admission, with the line of demarcation a beginning line of amputation. Temperature, 99.5° ; pulse, 88. Immediate amputation was advised but permission was withheld for three days. During this time infection set in and fever reached 104° F. Pain was present with the concurrent inflammation. He requested amputation of both feet.

As shown in the illustration, the left foot had suffered a loss of life by gangrene up to the calcaneo-cuboid junction; the right, to the ankle joint (fig. 1).

His condition did not warrant more than a two-stage operation. Under general anesthesia the right foot was amputated at the ankle joint. There was no bleeding. No attempt was made to do other than obtain drainage by hypertonic salt compress about the stump. The left foot was amputated at the calcaneo-cuboid articulation, and the stump was treated in the same manner. There was only slight bleeding. After an interval of two weeks, infection had subsided and healthy granulations had covered both stumps. An osteoplastic amputation of the right leg was performed at the junction of the middle and upper thirds. Pinch skin grafts were taken from the left thigh and applied to the left foot stump. Healing was kindly in both instances.

An artificial leg and foot were made by a native of Cape Haitien, as well as a shoe for the left half foot. Patient was walking about with the aid of a cane in a few days.

The Kahn test was 2 plus. There was no demonstrable lesion of treponematosis. The patient was in otherwise excellent physical condition. Systolic blood pressure, 125; diastolic, 95.

This pathological process whereby amputation of toes occurs is common in Haiti. Gangrene of both feet, however, is extremely uncommon.



FIG. 1.—ENDARTERITIS OF FEET WITH GANGRENE. (WILLIAMS)

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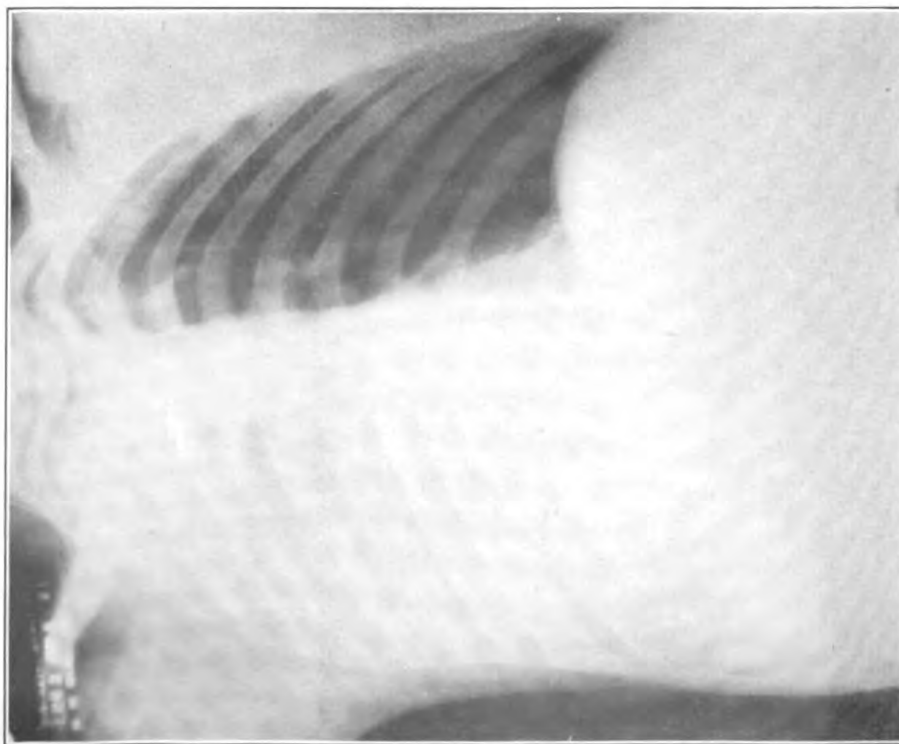


FIG. 1.—CASE 1, MAY 21, 1925. MASSIVE COLLAPSE. (KINDEL-
BERGER)

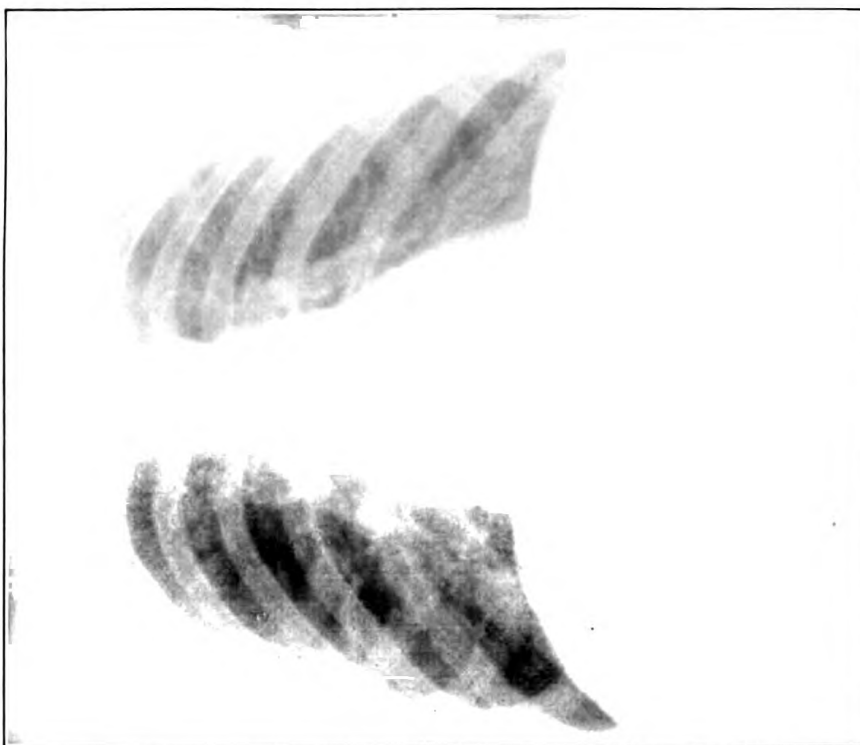


FIG. 2.—CASE 1, JUNE 23, 1925. LUNG REFILLED WITH AIR.
(KINDELBERGER)

OBSTRUCTIVE MASSIVE ATALECTASIS OF THE LUNG

REPORT OF SEVEN CASES

By C. P. KINDLEBERGER, Captain, Medical Corps, United States Navy

In Archives of Surgery, February, 1928, Coryllos and Birnbaum reported the results of some experimental work with dogs, which had been carried on by them in an attempt to solve the question of the etiology of massive collapse of the lung. They concluded from their own observations, as well as from the history of cases previously published, that there is only one cause of this condition. As stated by them: "... A careful study of the clinical symptoms, the physiologic phenomena, the Röntgen-ray observations on serial pictures, and the pathologic and bacteriologic condition of our animals convinced us that there is but one cause in the production of collapse of the lung, and that is the more or less temporary, but complete, occlusion of a bronchus by a plug of mucus acting as a foreign body, and intercepting completely the penetration of air into the portion of lung depending on the occluded bronchus. Complete obstruction is an indispensable factor for the production of this syndrome. . . ."

Credit is given by Coryllos and Birnbaum to Chevalier Jackson and his associates for having added much to our knowledge concerning the etiology and treatment of collapse of the lung through their perfection of bronchoscopic investigation, and the writers conclude that in cases of bronchial obstruction, when simple measures do not serve to remove the obstructing agent quickly, it must be removed by bronchoscopy with aspiration or extraction.

Massive collapse of the lung is generally thought to be not a common condition, yet seven cases have been recognized in the Mare Island hospital during the past four years. Brief histories of these cases are given below.

CASE REPORTS

Case 1.—H. F. McC., HA2c, United States Navy, Age, 19. Admitted to hospital May 8, 1925, with acute tonsillitis. This followed its usual course and on May 19, 1925, after recovery was complete, double tonsillectomy was performed under local anesthesia with procaine. The operation time was eight minutes; there were no hemorrhages; and the patient reacted well. On the next day, the patient's temperature was 102° F.; pulse, 100; respiration, 30. On the 21st, at 8 a. m., the patient complained of pain in his chest. At this time the temperature was 103° F.; pulse, 125; and respiration, 35. The right lower lung was dull to percussion. Left lung, hyperresonant. Heart pushed markedly to right. DIAGNOSIS: Massive collapse, right lower lobe and possibly middle lobe. At 1 p. m., X-ray examination (fig. 1) showed the left lung to be emphysematous throughout. The entire right-lung field and right diaphragm were obscured by a uniformly dense shadow. The trachea and heart were displaced toward the affected side. At 2 p. m. the patient was re-

examined and the upper right lung was found to be dull and the heart further to the right. There was tubular breathing in the middle line of right half of chest. May 23, 1925, the upper right lung was more resonant and few breath sounds could be heard. On the same date the X-ray showed the lower half of right lung to be obscured by a homogeneous shadow, while the upper half was mottled and clearer than in the previous film. There was a small rarefied area laterally in the second interspace, which has the appearance of air in the chest. On the 25th the temperature was normal; pulse, 85; and respiration, 30. X-ray pictures were taken at intervals and showed the lung to be clearing up gradually. June 23rd the X ray showed the lung fields to be essentially normal (fig. 2). On the 7th of July the patient was discharged to duty, well.

Case 2.—G. F. W., Pvt., United States Marine Corps. Age 24. Admitted to hospital May 22, 1926, complaining of shortness of breath. Five days before he had awakened at 4.30 a. m. with pains in lower right quadrant, which radiated all over abdomen and chest. He was nauseated, but did not vomit. Was admitted to sick list at marine barracks and was transferred to hospital on this date. The diagnosis of appendicitis was made, and patient was operated upon immediately.

Appendectomy was performed under local anesthesia (procaine); a greatly swollen, red appendix, covered with fibrin and with its lumen filled with pus, being removed. The abdomen was closed without drainage. May 23, 1926, the day following operation, patient became short of breath and complained of cough and some pain in right chest. Physical examination showed displacement of heart to right and dullness and increased breath sound over right base. The diagnosis of collapse of the lung was made and was confirmed by the X ray. On the morning of the 24th patient suddenly developed pain in chest, shortness of breath, moderate cough, slight fever, rapid pulse, and moderate cyanosis. The apex of the heart was apparently just to the right of the sternum and there were dullness and distant breathing over the base of the right lung. X ray showed a homogeneous shadow obscuring the lower two-thirds of the right lung, with the heart and mediastinum displaced to the right. **CONCLUSION:** Collapse of lower two-thirds of the right lung. This patient recovered from the lung collapse, as shown by X ray, by June 1, and was discharged to duty in good condition June 9, 1926.

Case 3.—A. F. F., SC2c., United States Navy. Age, 25. Readmitted, October 4, 1926, from U. S. S. *Medusa* complaining of pain in pit of stomach for past year. A diagnosis of appendicitis was made and appendectomy was performed on day of entrance to hospital. Spinal anesthesia (stovaine) was used and the abdomen was drained. Two days later (October 6, 1926) the drain was removed. Patient at this time was coughing and there was moderate expectoration. Examination disclosed dullness, distant bronchial breathing, and sonorous râles over right base. Tympany over left base. Heart displaced to right—apex 1 inch inside nipple line. Clinically, the case appeared to be one of massive collapse of the lung. October 7, 1926. X ray showed a homogeneous shadow obscuring the lower third of the right lung, up to the middle interlobar septum, which was thickened. The heart was not displaced to the affected side. **CONCLUSION:** Infectious process in the right base. An X-ray picture taken two days later (October 9, 1926) did not show the shadow found in the earlier film and it was concluded that this must have been due to collapse of the air cells in the right lower lobe. **CONCLUSION:** Well-aerated lower right lobe two days after collapse. This patient made an uneventful recovery from his lung condition and from the appendectomy, but was discharged from the service February 9, 1927, because of psychoneurosis, neurasthenia.

Case 4.—L. H. B., Veterans' Bureau patient. Age, 35. Admitted February 2, 1927, with right inguinal hernia. Operation, February 8, 1927. Bassini repair. Appendix removed through herniotomy wound. Spinal (stovaine) anesthesia. Three days after operation (February 11, 1928) there was a sudden onset of cough, expectoration, cyanosis, dyspnea, fever, and tachycardia. Over the base of the left lung there were dullness and distant breathing. The heart was displaced to the left; apex in fourth interspace. X ray showed collapse of left lung, except upper portion. **CONCLUSION:** Extensive collapse of left lung following repair of inguinal hernia. On the 12th, X ray showed lung field to be clear and heart back in its normal position. February 13, 1928: Sudden relief of pulmonary symptoms, following a coughing attack with copious expectoration. Typical attack of massive collapse of lung. The patient was discharged, well, March 11, 1927.

Case 5.—H. W. D., HA2c, United States Navy. Age, 23. Admitted May 10, 1927, complaining of pain at site of hernia operation, right side, performed three years ago. Operation, May 12, 1927, for recurrent right inguinal hernia. Spinal (stovaine) anesthesia. May 15, 1927, complained of cough, expectoration, and pain in chest. Temperature, 103° F.; pulse, 120. Dullness throughout right chest. Tubular breathing. Heart displaced to right. X ray showed right upper lung field obscured by homogeneous shadow and heart displaced slightly to the right. Several infiltrated areas in the middle lobe. **CONCLUSION:** Collapse of upper right lobe. May 20, 1927, X ray showed right upper lung clear, but numerous small infiltrated areas remaining. June 18, 1928, the patient was discharged to duty well.

Case 6.—A. H. O., Lieutenant (junior grade), United States Navy. Age, 27. Admitted to hospital March 6, 1928, with indirect left inguinal hernia. Operation, March 8, 1928: Bassini repair of medium-sized left indirect complete inguinal hernia. Ether anesthesia. March 10, 1928, temperature, 101° to 102° F.; pulse, 110; respiration, 25. Considerable respiratory distress. Heart displaced to right. Signs of massive collapse of right lung. No X ray pictures taken. March 15, 1928, signs of pulmonary collapse clearing up. Discharged to duty, well, April 17, 1928.

Case 7.—H. B. T., Veteran's Bureau patient. Age, 34. Admitted to hospital March 6, 1928, complaining of pain over right lower abdomen, nervousness, and pain in lungs. Examination and study of patient made it appear that he was suffering from neurasthenia. X-ray examination, March 22, 1928, raised the question of a duodenal lesion or chronic appendicitis and on the 29th, appendectomy was done under ether anesthesia. March 30, 1928; temperature, 102° F.; pulse, 106, respiration, 36. Wheezing, whistling, and squeaking râles over entire chest. X ray showed the left lung field to be obscured by a homogeneous shadow. The upper third of the right lung was likewise obscured. Marked narrowing of the intercostal spaces on the left side. Heart displaced to the left. **CONCLUSION:** Collapse of the left lung and upper lobe of the right lung. April 5, 1928, X ray showed considerable expansion of the lung. Heart still displaced to left. Discharged to duty May 3, 1928, wound healed.

TREMOR OF TONGUE IN SYPHILIS

By WILLIAM F. MURDY, Lieutenant, Dental Corps, United States Navy

While operating on patients affected with secondary syphilis, it was noticed that a number had a tremor of the tongue, some to a slight degree, and others quite marked. From an examination of

the mouths of 90 syphilitic patients it was found that 25.5 per cent had this condition, while an examination of the mouths of 100 without a syphilitic history showed that only 10 per cent had a trembling of the tongue.

I have considered that most patients undergoing dental treatment are nervous and apprehensive, some affected more than others, but when a tremor of tongue is manifested in only 10 per cent of non-syphilitics and is found in 25.5 per cent of syphilitics the conclusion is reached that this condition, in 15.5 per cent of theluetics treated, could be caused by the disease or by the systemic effect of mercurial or arsenical preparations used in treatment of the disease. According to Gould¹ "Mercurial tremor is a peculiar form of tremor observed among smelters and others exposed to the fumes of mercury. It is sudden and gradual in onset and is sometimes unaccompanied by salivation. The arms are first involved and then the entire muscular system. Lead and zinc poisoning also cause general tremors."

Stevens² states that "trembling of the tongue is noted in many conditions; it is particularly marked in asthenic fevers (typhoid), in alcoholism and in parietic dementia." Tremors are also caused by chronic poisoning with arsenic.

The men examined were from several different ships and were under specific treatment. Serum tests for the disease had been made in most of the cases and showed a reaction varying from five negatives to a Kahn 4 plus.

The secondary rash or roseola, mucous patches, chronic fissures at corner of mouth, sore throat, etc., are not present in every case of syphilis, likewise it was found that a tongue tremor was not found in all cases with a luetic history.

As the patients were not examined prior to luetic treatment it is undetermined whether the tremor is caused by the mercurials or is a manifestation of the disease. Note is made above that only 10 per cent of nonsyphilitics showed this condition. It might show that mercurials or arsenicals had been given beyond their tolerance. Examination for tremors in other parts of the body was not made.

Whatever the cause of the tremor, this sign may be of some value when considered with other manifestations of the disease, all of which are not always present.

GRAPH FOR DETERMINING WEIGHT VARIATION

By F. K. SOUKUP, Lieutenant, Medical Corps, United States Navy

The accompanying graph (fig. 1) is useful for quickly determining whether an individual varies from the average weight of healthy adults and the degree of such variation. Although the graph is

¹ Gould-Scott: The Practitioner's Medical Dictionary.

² Stevens: Practice of medicine (11th edition).

so constructed that the factors of height and age receive proper weight, and at first glance appears complicated, it really is simple in use.

The heavy vertical lines represent any age falling into the age group indicated at the bottom of the graph. The lighter vertical lines do not represent intermediate years and age should not be interpolated between heavy vertical lines.

The graph is used thus:

Find the height of the individual in the left margin. Follow the curved line representing that height until it intersects a heavy vertical line corresponding to the age group in which the person's age is included.

From this intersection draw or imagine a horizontal line across the graph. Where this horizontal line intersects the vertical line (heavy or light) corresponding to the person's actual weight, as read along lower margin of graph, place some symbol as X or \odot . This X or \odot will then be found to be located in one of the zones, indicated on the chart. The curve corresponding to 76-inch height and portions of 75-inch and 74-inch curve indicated by dotted line are based on probability, the data available being insufficient for plotting these. The graph presented here is for men only. A similar one can, of course, be constructed for women.

It may be found desirable for certain purposes, as for an annual health examination to use the same graph, in a card index for example, for the same individual year after year. Then one may have a continuous record of that individual's weight and variations from average weight during the course of a lifetime.

To avoid determining age when year of birth is given, as in statistical work, one may substitute calendar year groups for age groups. By subtracting, respectively, 20 and 24 from the current calendar year the first group limits are found in calendar years and placed at the foot of the heavy vertical line at the left instead of 20 and 24. The remainder of the age groups are likewise translated into calendar years.

A more convenient method is to take a strip of cardboard (see fig. 2) with a smooth true edge and laying it across the graph horizontally, rule vertical lines upon it, corresponding to the heavy vertical lines of the chart. Then label the vertical lines with calendar years determined as explained in the preceding paragraph. By sliding the strip of cardboard up or down over the graph until the proper birth year line at the bottom edge of the strip is in contact with the proper height curve, and then following the bottom edge of cardboard to the point at which it intersects the vertical corresponding to the weight of the individual, the location of X or \odot is found.

For statistical purposes one may go a step farther and print a code number within each zone. This code number may then be used for punching statistical cards.

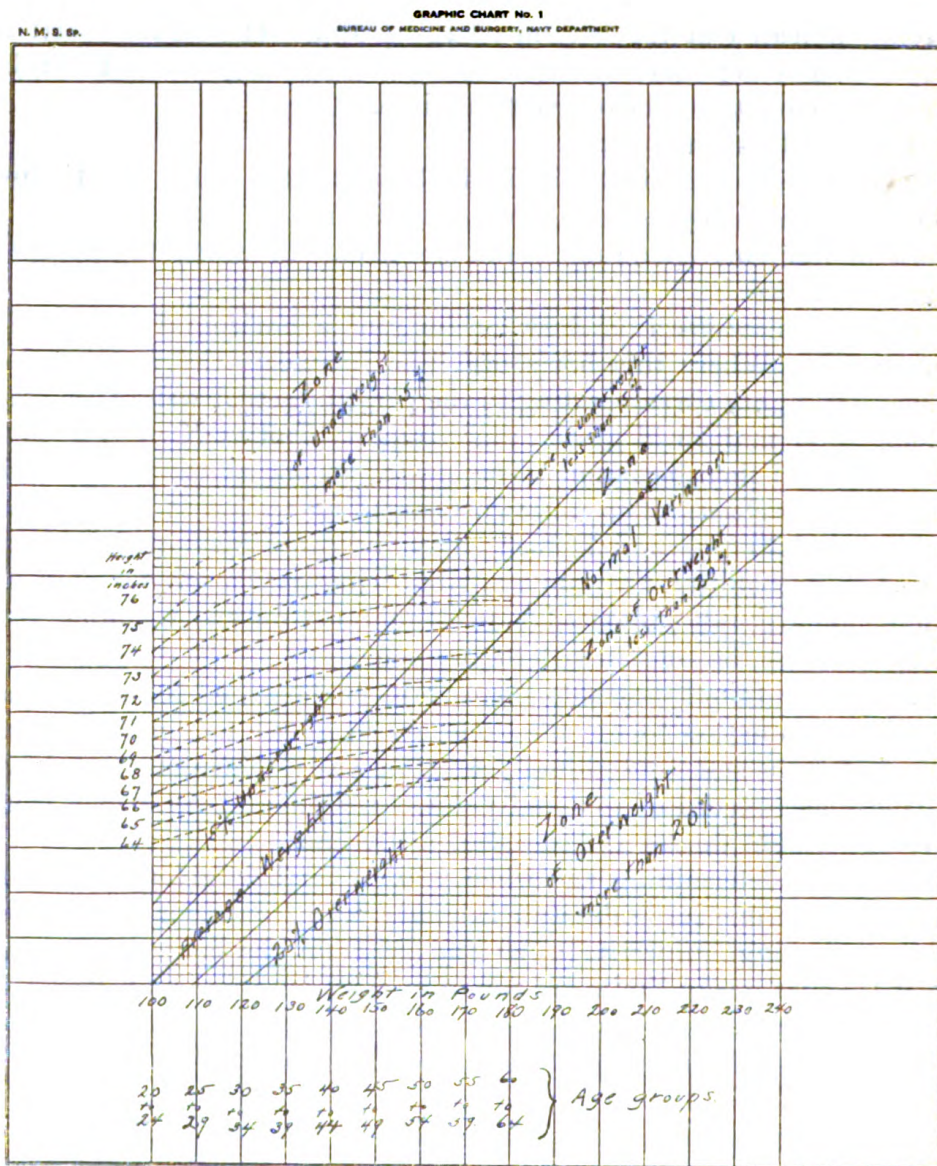


FIGURE 1

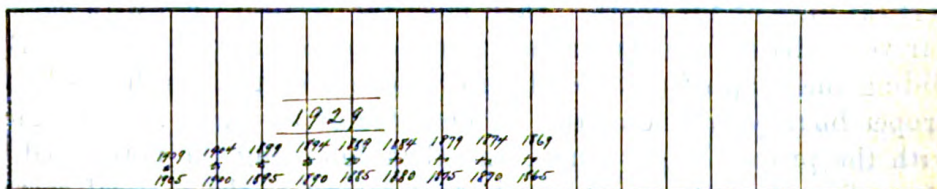


FIGURE 2

NAVAL RESERVE

TRAINING IN AVIATION MEDICINE

Medical officers holding commissions in the Naval Reserve and civilian physicians occasionally evince an interest in aviation medicine. In letters to the Bureau of Medicine and Surgery the civilians ask what, if any, instruction and training they may receive in aviation medicine if they enter the Medical Corps of the Naval Reserve. Reserve medical officers either ask for information of similar nature or request to be designated flight surgeons.

The manual of the medical department, United States Navy, 1927, defines flight surgeons as medical officers who have received training and been found qualified for this work (aviation medicine) at a school of aviation medicine, followed by three months' practical work with an aviation unit which has been satisfactory to the Bureau of Medicine and Surgery. Consequently, a medical officer can not be designated a flight surgeon until he has successfully completed his training.

There are several factors which determine whether or not a certain individual may be recommended for training in aviation medicine. First, of course, there must be a need for a flight surgeon in the locality where the applicant resides. The Bureau of Navigation stated some time ago in a letter to the commandants of the various naval districts that reserve aviation activities had been considerably handicapped in the past because accredited flight surgeons were not so located as to examine an applicant, student, or officer for flight training without entailing considerable travel and loss of time. In order to obviate this difficulty the Bureau of Navigation desired that 1 aviation medical officer be developed in St. Louis, Mo.; 1 in Detroit, Mich.; 1 in Los Angeles, Calif.; and 1 either in San Francisco or Oakland, Calif., for primary duty with the aviation organizations located in the places mentioned.

There being no need at present in other localities, no reason exists for recommending that medical men residing there be trained in aviation medicine. However, with the rapid expansion of aviation no one can say what the need will be in a given locality a month or a year hence. Medical officers of the reserve interested in aviation medicine will do well not to drop the matter as hopeless just because at present no need for flight surgeons exists in their locality.

A course in aviation medicine for medical officers of the regular Navy was given at the United States Naval Medical School, Washington, D. C., in 1927. Suitable applicants, one from each locality mentioned above, were also eligible. Reserve officers ordered to attend do so for two months and receive mileage, pay, and allowances of their grade while attending at the United States Naval Medical School. They must be willing, if volunteer officers, to perform the necessary physical examinations in their vicinity without financial remuneration, or if fleet officers they must be willing to perform the physical examinations as part of their regular duties.

It was reported to the Bureau of Navigation that medical officers often stated that they could not leave their practices for such a length of time to attend the course. The short and long of it was that the effort to develop flight surgeons in the Naval Reserve in the locations where they were needed bore no fruit. No one completed the necessary course satisfactorily.

The Bureau of Medicine and Surgery can not undertake to train men who have passed a certain age (usually 40 years) or men of such experience in other specialties that their paramount interest necessarily lies elsewhere and who can not be expected to develop along lines of aviation medicine. The amount of instruction to be given in a very limited time is such that it is doubtful whether any except those well grounded in the basic details and already familiar with physiological and abnormal conditions of the eyes, ears, nose, and throat, can profit by it.

At present it is not known when the next course in aviation medicine will be conducted.

For the information of those interested the following syllabus of courses given in the past at the United States Naval Medical School, Washington, D. C., is published:

A.—COURSE IN AVIATION MEDICINE

(Three months' course)

Cardiology and physical diagnosis:	Weekly
1. Tuesday, 10 to 12-----	2 hours.
Hygiene and sanitation:	
2. Monday, 1 to 2-----	1 hour.
Gas warfare:	
3. Monday, 11 to 12-----	1 hour.
Surgery:	
4. Traumatic surgery, Wednesday, 9 to 10-----	1 hour.
Clinical surgery, Wednesday, 10 to 12-----	2 hours.
Surgical laboratory, Tuesday, 2 to 3-----	1 hour.
Psychiatry, psychology, and personality study:	
5. Thursday-----	6 hours.

Ophthalmology and otology:**Weekly**

6. Monday, 10 to 11, and 2 to 4----- 3 hours.
 Friday, 10 to 11, and 2 to 4----- 3 hours.

Physiology:

7. Didactic—

- Wednesday, 1 to 2----- 1 hour.
 Saturday, 9 to 10----- 1 hour.

Laboratory and rebreather runs—

- Wednesday, 2 to 4----- 2 hours.
 Saturday, 10 to 12----- 2 hours.

Physiological chemistry:

8. Tuesday, 1 to 2----- 1 hour.

Meteorology:

9. Friday, 9 to 10----- 1 hour.

Special subjects:

10. (Invited) Tuesday, 9 to 10----- 1 hour.

Psychology of flying; duties of flight surgeon:

11. Monday, 9 to 10----- 1 hour.
 Friday, 11 to 12----- 1 hour.

Practical examination for flying:

12. Friday, 1 to 2----- 1 hour.

B.—COMBINED COURSE (BASIC PLUS AVIATION MEDICINE).**CURRICULUM**

Semesters to be of eight weeks duration.

First semester for entire class.

Second semester in two sections:

1. General section.
2. Aviation section.

Both sections:

First semester—

	Hours per week	Total hours
Eye, ear, nose, and throat-----	9	72
Medicine—		
General physiology-----	1	8
Cardiology and section work-----	4	32
Surgery—Traumatic surgery and surgical laboratory----	3	24
Psychiatry (general)-----	3	24
Laboratory—		
Pathology and serology-----	3	24
Aviation physical examinations-----	6	48
Special—		
Medical department duties-----	2	16
Gas defense-----	2	16
	<hr/> 34	<hr/> 272

Second semester, general section—

Medicine—

- Tropical medicine----- 4 32
 Basal metabolism----- 1 8

Surgery—

- Clinics----- 3 24
 Urology----- 1 8

Both sections—Continued.

Second semester, general section—Continued.

Laboratory—	Hours per week	Total hours
Bacteriology and medical zoology-----	6	48
Bacteriology and hematology-----	3	24
General chemistry-----	6	48
Clinical chemistry-----	6	48
Hygiene—		
Naval Hygiene-----	4	32
Field service-----	2	16
	<u>34</u>	<u>272</u>

Second semester, aviation section—

Medicine—

Cardiac efficiency and physiology of neuro-muscular system-----

1 8

Physiology of altitude-----

2 16

Neuro-psychiatry—

Psychology-----

2 16

Personality analysis-----

2 16

Mental hygiene-----

1 8

Aviation administration-----

1 8

Aviation examinations (rebreather, etc.)-----

6 48

Special: Aerodynamics, etc-----

3 24

18 144

NEW APPOINTMENTS

Name	Rank and class	Date
Behen, William Clement-----	Lieutenant (junior grade), MC-V(G)-----	June 27, 1928
Chapman, Sinis Atkins-----	Lieutenant (junior grade), MC-V(G)-----	Sept. 28, 1928
Davis, George Breed-----	Lieutenant (junior grade), MC-V(G)-----	Oct. 8, 1928
Gertson, George Dewey-----	Lieutenant (junior grade), MC-V(G)-----	Aug. 3, 1928
Haight, Harry Hurless-----	Lieutenant (junior grade), MC-V(G)-----	Sept. 28, 1928
Harrison, Roy B-----	Lieutenant commander, MC-V(S)-----	July 20, 1928
Holbrook, Ralph Waldo-----	Lieutenant commander, MC-V(S)-----	July 19, 1928
Kimball, Francis Nelson-----	Lieutenant, MC-V(G)-----	Aug. 2, 1928
Kinney, Lyell Cary-----	Lieutenant commander, MC-V(S)-----	Aug. 3, 1928
Larson, Lawrence M-----	Lieutenant (junior grade), MC-V(G)-----	July 20, 1928
McCormac, Edward Phillip-----	Lieutenant, MC-V(S)-----	Sept. 28, 1928
Menville, Leon John-----	Lieutenant commander, MC-V(S)-----	Sept. 26, 1928
Morrison, Marriott True-----	Lieutenant (junior grade), MC-V(G)-----	May 23, 1928
Musselman, Wendell Holmes-----	Lieutenant (junior grade), MC-V(G)-----	Aug. 23, 1928
Rutledge, Richard Martin-----	Lieutenant (junior grade), MC-V(G)-----	July 18, 1928
Smalzried, Elmer William-----	Lieutenant (junior grade), MC-V(G)-----	Aug. 16, 1928
Shnayerson, Ned-----	Lieutenant (junior grade), MC-V(G)-----	July 12, 1928
Solis-Cohen, Leon-----	Lieutenant commander, MC-V(S)-----	June 6, 1928
Strumia, Max Maurice-----	Lieutenant, MC-V(S)-----	July 19, 1928
Sussex, Lloyd Thomas-----	Lieutenant (junior grade), MC-V(G)-----	Aug. 20, 1928
Sweetser, Horatio B-----	Lieutenant (junior grade), MC-V(G)-----	Sept. 26, 1928
Wall, James Hardin-----	Lieutenant (junior grade), MC-V(G)-----	Aug. 1, 1928

PROMOTED

Byers, Horace Wellington-----	To lieutenant commander, MC-F-----	July 17, 1928
Case, Otis Jameson-----	To lieutenant commander, MC-F-----	Sept. 6, 1928
Orwig, Earl Albert-----	To lieutenant commander, MC-F-----	Sept. 6, 1928

NURSE CORPS

THE INSTITUTE FOR NURSES

By ISABELLA F. ERSKINE, Chief Nurse, United States Navy

Under the auspices of the Illinois League of Nursing Education an inspiring and interesting series of lectures and demonstrations was given at the annual institute for nurses held in Chicago from June 18 to June 29, 1928. Among the subjects included were psychology, principles of teaching and learning, sociology, effective speaking, and lectures on other subjects appertaining to the different branches of nursing.

The psychology was of an elementary nature and was arranged especially to introduce to the nurse the modern tendencies in psychology. The neurological concept, with emphasis placed upon the nervous structure necessary for adaptation; the behavioristic concept, with emphasis placed upon the observable activities of the individual; and the biological concept, with emphasis placed upon the dynamic relationship between the individual and his environment, were clearly and instructively explained by Professor Blatz.

The lectures by Miss May Kennedy on The Principles of Teaching and Learning, considered the psychological basis of teaching and learning, special application of it being made to the teaching of student nurses to make use of the psychological factors of learning.

Her first lecture was on the importance to the student and teacher of having an aim. She then read "aim" as defined by such eminent educators as Doctor Bagley, Doctor Charters, Doctor Dewey, and Doctor Spaulding. When discussing the aim in nursing education, the instructors were urged by Miss Kennedy to consider, in addition to the definite courses of study embodying theory and practical experience in nursing, the physical, the intellectual, and the moral nature of the student. For the physical, to arouse a keen appreciation of health and of the environment conducive to health, stressing the importance of knowing and following the laws of hygiene. For the intellectual, to teach them to cultivate proper habits of thinking, to provide means and opportunities to aid in developing the habit of evaluating and supplementing the subject matter presented, and to help them to acquire the power to work in spite of the difficulties and to visualize results. For the moral, to teach them to cultivate

an ideal, arousing a love for the good, the true, and the beautiful with a desire to attain a high degree of moral perfection. Miss Kennedy pointed out that the true measure of human worth is moral, not intellectual or physical attainment. She asked that each supervisor in the field of nursing strive to cultivate in the student high ideals, as accuracy, truthfulness, kindness, and sympathy, not as temporary standards to be observed during the years while under supervision but as permanent developments of noble upright personalities.

The functions and qualifications of an instructor were next considered. The function is manifold and requires many qualifications. She must make learning contagious, give references to help in acquiring knowledge, show how to make the best use of faculties, and study the students' future needs. She must teach the student to promote habits of thought, give suggestions and praise, and aspire to greater work. She must possess instinctive tendencies, have a knowledge of psychology, have an imagination, know what the world is demanding, have enthusiasm for her work and the power to invigorate others. She must possess high ideals of the nursing profession and must have special knowledge in nursing and in special subjects. Her's must be a deep and abiding interest in young people and in education.

If more than two subjects are taught by one instructor, allied subjects should be chosen. That the imparting of knowledge is the lesser thing, directing and guiding the greater thing, was well shown.

In the third lecture, the "student" was considered. "What have we to work with?" was the question. "A nervous mechanism with definite characteristics," was the reply. She then discussed the following characteristics: plasticity, capable of being changed by influence to fullest development; preliminary state of readiness, neurones in a state of readiness for reaction and development to stimuli; and native tendencies to react in a certain manner. Miss Kennedy pointed out that each student, being a separate and distinct personality with a native equipment peculiar to her own self, should be treated as an individual and whatever in her is outstanding, or that which is undeveloped, should be developed. The tendency to misunderstand the student during her period of adjustment to her new environment, the different types of subjects to be studied, and the new method of study were then considered. As a possible solution to this situation, it was suggested that we assist the student with the new problems presented by her new environment, prove to her that the world is a kind place in which to live, and refrain from too much suppression.

The next lecture considered the essential factors of the learning process. Learning is a native capacity and dependent upon certain characteristics of the human mechanism, which include the receiving, connecting, and response mechanisms.

Educators attach much value to habit formation, because habit insures quickness, accuracy, and uniformity in activity. Habit formation is possible, say psychologists, because of the structure of the nervous system and the plasticity of the neurone system and the laws governing its functioning. The laws which govern the function of the nervous system and upon which all learning depends, include the laws that govern the selection and the laws that govern the fixing of a reaction. The necessity for a nurse to acquire both intellectual and physical habits was emphasized by Miss Kennedy, because of the scientific nature of nursing, and the high degree of intelligence required.

Character, the end product of education, is made up of habit. James says, "The greatest thing in all education is to make our nervous system our ally instead of our enemy. Therefore in early youth we should make automatic and habitual as many useful actions as we can and guard against growing into ways that are likely to be disadvantageous to us as we should guard against a plague. The more of the details of our daily life we can hand over to the effortless custody of automatism the more our higher powers of mind will be set free for their own proper work." The three great maxims to be adhered to are, first, "Launch ourselves with as strong and decided an initiative as possible"; second, "Never suffer an exception to occur till the new habit is securely rooted in your life"; third, "Seize the very first possible opportunity to act on every resolution you make, and on every emotional prompting you may experience in the direction of the habits you aspire to gain."

A lecture on the principles of economy in learning followed the one on habit and was based upon certain fundamental facts relative to the native characteristics of the nervous mechanism, the laws of learning, and the methods of learning based upon experimental study. Memorizing, as a form of learning, was considered from four aspects: Acquisition, being the process by which facts and events become a part of our mental mechanism; retention, being a resting state in which the learned events or facts remain until they are called into consciousness; recall, being the power to bring into consciousness facts and events which have once been experienced; and recognition, the feeling of familiarity when seeing an object.

During the lecture on the technique of study, Miss Kennedy defined study as a mental activity, the response to a felt need; its purpose being to secure knowledge, which is the acquired ability to do

things, and mental, physical, and intellectual development. There are three forms of study—reading, reflective thinking, and observation. Reading may be done in three ways—skimming, reading to understand, and memorizing; with reflective thinking, one asks oneself, how, why, where, who, when, and which; and observation is the ability to interpret in a proper way—a very important form of study for nurses. Here, emphasis was placed upon the need for a system, the importance of having a program, and the preparation of the mind for the task of asking oneself certain questions pertaining to the subject to be studied. It was during this lecture that Miss Kennedy reminded the supervisors and instructors present that supervised study was directed study, therefore, students should be taught what is to be expected of them later. First impressions should be made as vivid as possible and as many connections as possible made with the new thought by tying new material to the old. Connections should be made logical, and the subject kept before the student at varying intervals throughout the period of instruction. It is felt that present day students are not good workers or thinkers, and that the fault lies in the method of instruction. She appealed to the instructors to direct the studies in the schools for nurses so as to create a situation which would develop independent thinkers, and to encourage and teach the students to ask questions of their instructors, upon their subjects. The subjects presented to students after completion of high school should be comparable to college work if one wishes to hold the interest of the advanced pupils. Interest must be encouraged and developed if study is to result. Charters says, "Teaching is assisting the pupils to appreciate and control the values of life."

The curriculum for the schools of nursing was the last thing considered. When this was discussed it was suggested that the curriculum be readjusted to present day methods of thought. Here the importance of including English, psychology, and psychiatry was stressed. Psychiatric nursing should be based upon a knowledge of psychology, and as an illustration of the present-day methods of caring for the mentally sick compared with former methods, we were reminded of the days when everything was removed from the room of a patient suffering from suicidal tendencies, thereby forcing upon the sufferer conditions which would make life unbearable for the strongest mentality. The method to-day is to improve their surroundings and attempt to help them to find life worth while.

During the lectures on sociology, many interesting charts and figures demonstrating the relations and effects of the different phases which go to make up a community were shown. The conditions of a community which affect the health of the public and how it in

turn affects the other units of a community, were most interestingly and instructively demonstrated.

As the lectures on the principles of teaching and learning were based upon the laws of psychology, so also were the lectures on public speaking by Professor Nelson. When approaching an audience, assume a manner which indicates you have something to say that is worth hearing. Arouse interest at once if you want attention; maintain interest if you wish to see on the faces of your student audience the expression of an understanding interest. He also pointed out that confidence in self only comes with practice and must be obtained before the confidence or attention of an audience can possibly be gained. He discouraged the method of memorizing a speech, but advocated that an outline of the subject be made and then discussed with everyone met, from whom a different point of view could be obtained; and to prepare oneself to meet the subject from every angle.

A WEEK WORTH WHILE¹

We wonder if many of the staff nurses realize what is to be found at the Pharmacist's Mates' School at Portsmouth, Va. Although we have been in the service for 10 years and have been receiving student corps men for instruction in our wards, we had no conception of the facilities for their initial foundation as pharmacists of the United States Navy.

When we walked into the nursing laboratory we were amazed. Well equipped classrooms or laboratories with every available hospital appliance were found, so that the student may actually put into practice each theory studied.

We have been attending classes for the last week and find a perfectly organized routine, with every subject so well presented that the theoretical and practical demonstrations are correlative. If advisable, part of the class act as subjects, otherwise the manikins are in daily use in all demonstrations. It would be a revelation if each and every nurse could visit these laboratories and see the work demonstrated in the homelike atmosphere that prevails throughout the classrooms. It is evident that there is complete cooperation among members of the entire staff.

The dietetic laboratory is the place that would appeal to every nurse, for it is so perfect in detail that one feels the desire to stop and prepare the many delicacies that patients require. There is a small dining room also, most attractively arranged with covers for eight.

¹ The impressions of two nurses who had been at the Pharmacist's Mates' School for one week only.

The entire nursing laboratory is not only like the up-to-date classroom that one finds in our largest universities where nursing has become a part of the curriculum, but there has been added a touch of hospitality. This is true as one enters the building, for the attractive library on the left draws one inside. Two large bookcases afford ample references for the instructors. On the walls are pictures of past graduating classes, instructors of the school, commanding officers, and departmental heads of various nursing organizations. Beautiful potted ferns and hanging baskets of ivy add to the home-like atmosphere.

Throughout the classrooms are charts of the practical demonstrations so cleverly drawn that we were amazed to learn that this was the work of men who had been in the school less than three months. We are not exaggerating when we say that this has been a week of continual surprises. Our interest has not lagged for one minute and we feel that a person should accomplish much when surrounded by the material and atmosphere that one finds here.

IMPRESSIONS AND CONCLUSIONS AFTER MORE THAN A YEAR OF DUTY AT THE PHARMACIST'S MATES' SCHOOL

One of the nurse instructors at the Pharmacist's Mates' School has written a letter which tells something of her enthusiasm after more than a year of duty at the school. Excerpts from this letter are quoted to supplement, or as a sequel to, the preceding letter from two nurses who had spent only one week at the school.

"In the first place, I want to say that this has been one of the busiest, most interesting and happiest years of my life. Of course there have been little ups and downs, sometimes they seemed big ones right at the time, but later, in retrospect, they were just the normal reactions to pleasant or unpleasant minor situations which exist in all organizations and help to break the monotony and keep up one's active interest in life.

"When I first came here, I, too, had the same feeling of surprise and amazement at the complete equipment, the smoothly running organization, and the ability and enthusiasm of the instructors, not only in our own nursing laboratory but in the other departments where the doctors, pharmacists, chief pharmacist's mates, and mates, each a specialist in some branch of instruction, so ably carry on. It was my great pleasure to visit classrooms in these other departments with Miss Potocka, the Polish nurse, who was here observing the methods and plan of instruction at the school. I enjoyed seeing the men at their work of instruction with men and as we usually all have classes at the same time, the only time we meet is at the biweekly

conferences, where we compare notes as to the desirability or undesirability of retaining or dropping some of our recent admissions.

"Usually our impressions of the men are much the same, but now and then there is a difference of opinion. Sometimes we feel that a man, even though he makes grades well above the passing mark, is quite unfit for the hospital corps because of certain outstanding tendencies and characteristics. I am always ready to speak a good word for the man who has had faulty educational advantages and thus finds it hard to express his thoughts on paper, in fact, very hard in some of the subjects, because of his poor groundwork in English. At the same time this man may be so eager, try so hard, be so trustworthy, and so readily grasp the practical work in the nursing laboratory that we know he would make an excellent man on the wards even though he could never make the higher ratings without better educational foundation. It goes without saying that, other things being equal, the man with good educational foundation who is interested in the work of the Hospital Corps is the one who will be most valuable to the corps and the greatest credit to the Pharmacist's Mates' School. Native intelligence, however, and keen observation surmount many obstacles of early educational deficiency.

"I am sure you will understand by reading between the lines as well as the lines themselves that my enthusiasm still holds good. Never has time flown so fast, and 12 midnight comes before I am half ready for it. I thoroughly enjoy the class work and the preparation for it, especially when the students are responsive and grasp the underlying principles and demonstrate in their practical work fundamentals of the procedures which we in so short a time carry out before them and then with them. A class of 22 just finishing their fourth week has been the joy of our hearts, 22 men on time, 22 men attentive and interested, 22 men responsive and receptive, showing both in written essays and answers to quizzes, as well as in practical work, that the work of their instructors is bearing fruit.

"Nurses from outside who have visited the school have declared the equipment more complete than they have seen anywhere else, and Miss —, the school inspector for schools of nursing in the State of Virginia, asked if some of the students from the Portsmouth hospitals could not attend, as guests, some of our demonstrations. This fills us with pride, but makes us feel, also, how great is the necessity for us to live up to the high standards imputed to us."

THE PUBLIC HEALTH SERVICE OF SAMOA¹

By GRACE PEPÉ, Samoan Chief Nurse

I come from the islands of American Samoa and I have been asked to read a paper to you at this meeting. In American Samoa we have no women in industry, no paupers, and no dependent children or old people. So I have decided to discuss briefly the history of the development of our public health service.

Before the United States Navy came to Samoa, the Samoan people did not realize the importance of proper care of themselves and their villages. Wounds and sores, if treated at all, were merely covered with the leaves of trees and bushes. Ill people were dosed with the steepings of barks and herbs. Of course we know to-day that these treatments were usually of no benefit.

The United States Navy in 1900 established a naval station in Tutuila and the same year took over the government of the island. It was not until 1914, however, that a public health service was established. Before this time the surgeons of the station ship looked after the ailing natives. In 1911 a native hospital was started, but it was not finished until 1912. The hospital consisted of three large oval Samoan houses, and a wooden administration building containing an examination room and a dressing room. Later an operating room and quarters for the personnel were built.

In 1913 a training school for Samoan nurses was established and Navy nurses were detailed as instructors. The first class graduated in 1916. During the fiscal year 1919-20 the nursing of the entire hospital was taken over by the Navy nurses and the Samoan Hospital Training School. Before that time the student nurses were employed only in the women's and children's wards. In 1923 the 2-year course of training was increased to three years. At present we have as the personnel of our hospital 1 medical officer, 4 Navy nurses, 1 chief pharmacist's mate, 1 chief Samoan nurse, 3 pharmacists' mates, 1 hospital fitafita, and 26 Samoan nurses.

The graduate nurses alternate between the hospital and the districts. District details are from three to six months. The student nurses are obtained from various schools in American Samoa. The Samoan hospital is under the direction of the senior medical officer of the Navy, who is also the public-health officer.

The work in the districts is directed by branch dispensaries, of which there are four—two on the island of Tutuila and two in the Manua Group. A chief pharmacist's mate of the Medical Corps of the United States Navy is in charge of each dispensary and also serves as district health officer. The personnel of each out-station

¹ Read before the Pan Pacific Women's Conference held at Honolulu, August, 1928.

also includes one pharmacist's mate (first or second class), who acts as sanitary inspector of the villages in his district. From one to three graduate Samoan nurses are assigned to each of the districts.

The district nurse goes from village to village visiting and treating the sick, instructing the mothers in the care of their babies, teaching general hygiene, and reporting births and deaths. As the years pass, the Samoan graduate nurses who go among the people in their homes are becoming better able to diagnose diseases and treat the sick, as well as to decide, with good judgment, what cases should be urged or sent to the hospital. The Samoan people can have free treatment at the hospital or the district clinics at any time. The present health officer believes that these district nurses will in the future become the most important single factor in educating our people to better hygiene and sanitation.

The most prevalent diseases of the Samoan people are yaws, elephantiasis, tuberculosis, epidemic conjunctivitis, and intestinal parasites, including hookworm. Yaws is being treated very successfully with neo- and sulph-arsphenamine. As elephantiasis is a mosquito-borne disease it is being combated by teaching the people precautions against the breeding of mosquitos and against mosquito bites. These instructions are to clear marshy land and to prevent breeding in tin cans and other small containers of water, and to sleep under mosquito nets. Filariasis, the primary infection that leads to elephantiasis, is so prevalent that more than 50 per cent of the Samoan people will show filariæ in their blood.

Recently we had a small epidemic of typhoid fever which was promptly traced to one of the soda fountains, and with discovery of the source of infection and proper precautions, the epidemic was limited to 17 cases, none of which were fatal.

In 1917 compulsory vaccination of all the Samoan people was carried out. Since that time smallpox has not visited the islands.

We have two cases of leprosy under treatment at the Samoan hospital. The Samoan people have been singularly lucky in escaping this dread disease. That is an example of the good work that has been done among the Samoan people by the Navy doctors and nurses. They have taught the Samoan nurses. We had no opportunity before of knowing anything about the care of the sick and the cause of disease. Since the American flag has been raised in Samoa the population has increased over 50 per cent. We Samoans feel very thankful that we are under the care of the United States of America.

As one of the delegates from American Samoa to this convention I bring the felicitations of my country to you all. My people are deeply sensible of the honor of being represented here.

NOTES AND COMMENTS

THE PUBLIC HEALTH SERVICE OF HAITI

The Annual Report of the Director General, National Public Health Service of Haiti, for the fiscal year 1926-27 is a record of achievement that is, to say the least, glowing and stupendous.

Those who are familiar with conditions of the past in Haiti and who appreciate the difficulties under which progress is accomplished there will realize what this record means to the welfare of the people of that Republic and will understand what it speaks for the administration of the two medical officers, Capt. C. S. Butler, Medical Corps, United States Navy, and Commander K. C. Melhorn, Medical Corps, United States Navy, who held the office of director general of the public-health service of Haiti during the period of the report.

MEDICAL EDUCATION

The most important achievement from the standpoint of the advancement of medicine in Haiti was in connection with the reorganization of the National Medical School and the completion of its new buildings. "In what was accomplished for medical education alone the period was one of intense interest and special importance. To all who participated in that movement our debt of gratitude is great. The completion of the new medical school buildings, the departure of seven members of its faculty to pursue their studies under Rockefeller Foundation fellowships in leading clinics of the world, and the arrival of teaching equipment (another gift of the Foundation) all have given an impetus and encouragement to the service that has penetrated to every nook and corner of the country."

MEDICAL CONGRESS

A valuable step was taken in bringing about closer and more cordial cooperation between the physicians of Haiti and the public-health service by the institution of the annual national convention of the newly organized Haitian Medical Society. The first session was held in May, 1927, the second in May, 1928. These were opened by the President of Haiti and were attended by Haitian doctors and American medical officers from all parts of the Republic.

RESEARCH

Research was carried on by several workers, both Haitian and American. The most extensive contribution was the work carried on by Lieut. Commander P. W. Wilson, Medical Corps, United States Navy, who, with medical officers of the United Fruit Co., made a very comprehensive malaria survey of various sections of the Republic. Using a single thick film examination, 26 per cent of adults were found infected, 80 per cent of these infections being of the malignant tertian type. Among the children as high as 90 per cent in some sections showed parasites on a single examination. A surprising fact was the large number of men who showed heavy infections, some of them as high as 50 to 70 rings to the field.

HOSPITAL, DISPENSARY, AND RURAL CLINIC SERVICE

The following figures give one an idea of how the Public Health Service program has expanded:

Annual admission to hospitals.....	7,551
Total out-patients treated, including rural clinics.....	673,389
Major operations.....	1,410
Injections for treponematosi (neosalvarsan and bismuth).....	378,749

During the latter months of the period these injections had reached an annual rate of a half million.

At 110 different places there were held 2,759 rural clinics. The real bulk of the work is carried on at these rural clinics, where a relentless campaign is on against the three great diseases of the peasant mass—treponematosi, malaria, and intestinal parasites.

ECONOMICS

During the fiscal year 1926-27 the service expended \$948,750, of which \$892,333 was contributed by the National Government. This amount was expended for routine sanitation and hospital work as well as for new constructions. Among the accomplishments for which this money was spent may be mentioned:

Sanitation.—The hauling of 102,000 loads of garbage and refuse which was used as filling in the mosquito-control work.

Twenty thousand gallons of oil used in mosquito-control work.

Five thousand school children vaccinated against smallpox.

Six thousand school children inoculated against typhoid.

Four thousand stray dogs killed.

Extensive drainage of swamps; canal and gutter construction in principal cities.

Construction of Parc Communal at Port au Prince.

Installation of chlorinator at water source, Port au Prince.

Establishment of sanitary service in rural towns.

Hospitals.—(a) *Port au Prince*.—Completion of building, which consists of two male medical wards, one female medical ward, morgue, pathological museum, and clinic room. Completion of administration building. New kitchen 90 per cent completed. Completion of building containing depot, pharmacy, and dental office. Construction of rural dispensaries at Cabaret, Leogane, Croix-des-Bouquets. Constructions started at Gressier, Kenskoff, Cornillon. Medical-school building completed.

(b) *Cape Haitien*.—Mess hall for men's ward constructed. Rural dispensaries constructed at Le Trou, Fort Liberte, and Vallieres. Constructions started at Plaisance and Grande Riviere.

(c) *Cayes*.—Rural dispensary constructed at Aquin.

(d) *Gonaives*.—Operating room and dispensary constructed. Rural dispensary constructed at Marmelade. Electric-light system installed at hospital.

(e) *Hinche*.—Servants' quarters, morgue, and carpenter shop constructed. Wire fence around hospital built. Construction of rural dispensaries begun at Lascahobas and Maissade.

(f) *Jacmel*.—Rural dispensary constructed at Saltrou. New roof and ceiling for main hospital building. Installation of X-ray equipment. Receipt of motor boat for rural clinics.

(g) *Jeremie*.—New dispensary building completed. Construction of rural dispensaries at Moron and Marfranc.

(h) *Petit-Goave*.—Hospital ward and dispensary constructed. Land purchased to enlarge hospital grounds. Rural dispensaries constructed at Grand Goave, Miragoane, St. Michel, Petit Trou, l'Asile, and Baraderes.

(i) *Port de Paix*.—Main hospital building constructed. Operating room constructed.

(j) *St. Marc*.—Men's ward constructed. Operating room constructed. Rural dispensaries constructed at Mont-Rouis and Carrefour Chaudiere.

Following is the future program for the development and operation of the Public Health Service through the fiscal year 1930-31:

1. Morgue, Haitian General Hospital, Port au Prince.....	\$14,000
2. Purchase and installation of refrigerating apparatus in morgue....	3,000
3. Improvement, Justinian Hospital, Cape Haitien.....	12,000
4. Improvement to pumping plant, Hinche Hospital.....	1,400
5. Quarters for assistant public health officer, Hinche.....	3,000
6. Twenty-five rural dispensaries.....	32,500
7. General improvements in sanitation.....	275,780
8. Hospital (200 beds) for patients with mental diseases, Port au Prince	56,000
9. Lazaretto (lepers) 25 beds, Port au Prince.....	14,000
10. Quarantine station, Port au Prince.....	38,000

11. Additions to hospital, Gonalves-----	\$14, 000
12. Improvements, Haitian General Hospital, Port au Prince-----	5, 400
13. Purchase of land for rural dispensaries-----	22, 000
14. Sisters' quarters, Hospital St. Marc-----	4, 600
15. Iron and masonry fence, Haitian General Hospital-----	12, 000
16. Masonry fence, quarantine station, Port au Prince-----	2, 400
17. Purchase of land for enlarging hospitals at Port au Prince, Petit Goave, and St. Marc-----	15, 000
18. Public-health nurse, scholarship-----	1, 800

INTESTINAL AMEBIASIS

Since yatren was first used by Mühlens and Menk in 1921 and stovarsol used by Marchoux in 1923 in the treatment of amebic dysentery, a great deal of work has been done in the testing of these drugs and much literature concerning them has appeared in the medical journals.

At the Carmichael Hospital for Tropical Diseases, Calcutta, single routine stool examinations on all admitted patients show 14 per cent to be infected with *E. histolytica*. Consequently, there has been an excellent opportunity at that hospital to test these and other drugs, not only as to therapeutic properties in the treatment of intestinal amebiasis, but also as to their efficiency in disinfecting carriers who are not suffering from dysentery.

An elaborate piece of such work has been done there and a very comprehensive report of it has been made by Lieut. Col. R. Knowles and his associates in the Indian Medical Gazette of August, 1928.

They state that the successful treatment of intestinal amebiasis is one of the most difficult and pressing problems in the practice of medicine in the Tropics and that "there are so many vaunted cures for this condition on the market to-day that the medical practitioner is positively embarrassed in his attempt at choice. Yet, the efficacy of any or all of them seems very much open to question."

They have traced some interesting curves to illustrate the extent to which various drugs have been in use since 1900. The curves have shown some "waves of popularity," and there has by no means been any particular correlation between popularity and actual therapeutic value of the drugs.

Ipecac held a high place in 1900, but fell completely into disuse by 1914. Emetine, from 1912, and emetine bismuth iodide, from 1915, came rapidly into favor, but have been declining since 1918, while yatren and stovarsol have been gaining since 1923.

After a very thorough analysis of their results these men conclude that "from amongst a host of supposed 'cures' for the condition there is not one that appears to be really efficacious or reliable." Apparently about as much may be accomplished by raising the patient's general resistance as by the use of weakly amebicidal drugs.

After the use of emetine injections alone there was 1 cure to 1.7 failures and there was 1 positive stool to 7 negative stools.

With emetine bismuth iodide there was 1 cure to 3.5 failures and 1 positive stool to 6.5 negative stools. Yatren, orally, gave results of 1 cure to 1.3 failures and 1 positive stool to 8 negatives. Yatren, orally, combined with yatren per rectum gave no better results.

Stovarsol gave results of 1 cure to 1.1 failures and only 1 positive to 13.6 negative stools. A combined treatment of stovarsol, orally, and emetine injections seemed to give the best results, but the group of patients on this form of treatment was too small for use in arriving at definite conclusions. No positive stools were noted after this form of combined treatment.

Those interested in the subject of amebic dysentery can find nothing better in the current literature than the lengthy paper accompanied by many beautiful plates which appears in the *Annals of Tropical Medicine and Parasitology* of August 28, 1928. This paper is contributed by W. M. James under the title "Human Amoebiasis due to Infection with *Entamoeba Histolytica*." The photographs of the microscopic preparations are by Lawrence Getz.

In the introduction he brings out the point of great variability in the clinical picture; for example, all degrees of ulceration with or without emaciation and with or without dysentery, and emaciation with or without ulceration. He believes that there are as many "latent histolytica infections" as those with dysentery, and that many gastrointestinal disturbances without dysentery or diarrhea may be due to amebic infections.

The importance of the disease in certain countries is well expressed by James: "Any parasite that infects from 5 to 20 per cent of the general population deserves interest, and we are considering here one that is responsible at times for a disease as protean in its symptomatology as syphilis and considered by many to be as chronic and as difficult of eradication."

Concerning the pathology, he believes that the first lesion is a solution and destruction of the mucosa, with congestion and thrombosis of the very small vessels. This is followed by invasion and the formation of the flask-shaped ulcers.

The symptomatology is usually that of an ulcerative colitis, but "that of any gastrointestinal condition may be simulated, from simple indigestion to obstruction and cancer." It may so resemble a chronic appendicitis that differentiation can be made only by operation.

In diagnosis three fresh stool examinations should be sufficient, as he has found the organism in 75 per cent of the cases on the first examination and in 90 per cent by two examinations. Wet-fixed and

stained or permanent preparations greatly reduce the probability of mistaking one organism for another.

As to treatment, his attitude is very much the same as that of Lieutenant Colonel Knowles. To quote James: "The many systems of treatment employed, the wide divergence of opinion as to their efficacy, the number of drugs that have been proposed from time to time offer eloquent evidence as to the long duration, frequency of relapse, and stubbornness of the disease."

For many years James has advocated large doses of bismuth subnitrate—12 to 14 grams to the dose, three to five times per day. This with rest, bowel irrigation when indicated, emetine according to the susceptibility of the patient, and proper diet gives, in his experience, "a high percentage of satisfactory results."

BLACKWATER FEVER

Blackwater fever is one of the most dreaded conditions with which one who must live in the Tropics is confronted and one which plays havoc with many Americans and Europeans in malarial districts. Many theories as to its causation have been advanced, no one of which has received general acceptance.

In the British Medical Journal, July 28, 1928, Blacklock and Macdonald present a new etiological theory which evidence leads them to believe is correct. The title of their paper is "The Mechanism of Blackwater Fever and Certain Allied Conditions."

Blackwater fever usually follows prolonged infection with *Plasmodium falciparum* and not infection with other malarial parasites. As this parasite produces no toxin which differs from that formed by other parasites, these authors conclude that the cause of the association must be sought for in some other biological factor. In this connection they say:

"The outstanding differences between *P. falciparum* and the other malaria parasites are that the former sporulates not in the peripheral blood but in the internal organs, and that the cells containing the sporulating forms adhere to each other and to the vessel walls. * * * Three observations serve to explain this tendency of the malignant tertian parasite to accumulate in the internal organs. Marchiafava and Bignami drew attention to the fact that corpuscles infected with malignant parasites, especially of the adult form, have lost their elasticity, and consequently resist the change of shape necessary for their passage through the capillaries, an observation which was again made by Bass. Next Thomson and Thomson recorded and illustrated marked clumping of the infected red cells in culture dur-

ing all stages of sporulation of *P. falciparum*, whereas no tendency to clumping occurred in cultures of *P. vivax*. * * * Their predilection for the internal organs was explained by Bass, who showed that they lodge in those capillaries where the current is weakest or where slight obstruction is produced by the protrusion of endothelial cells inward. The commonest and most important site of this massing of infected cells is the spleen, though the bone marrow and other organs may be similarly affected. * * *

The authors are convinced that the association between blackwater fever and *P. falciparum* depends upon these factors, and they sustain their argument by showing the similarity between blackwater fever and other forms of hemoglobinuria and hemoglobinemia.

The conditions which are compared with blackwater fever are: Hæmoglobinuria in pernicious anæmia with venous thrombosis; hæmoglobinuria in Raynaud's disease; hæmoglobinæmia in dogs as a result of exercise; hæmoglobinuria in man from marching; and myoglobi-nuria in horses. All of these are similar in that there is deficient oxygenation, although the manner in which the anoxæmia is brought about differs.

It is well known that in states of deficient oxygenation carbohydrate metabolism is disturbed, with the result that an excess of lactic acid accumulates in the blood. Normally, in a resting individual, the blood contains about 20 milligrams of lactic acid per 100 cubic centimeters. Various investigators have found increases of lactic acid up to 100 to 200 milligrams per cubic centimeter of blood in conditions in which anoxæmia occurs.

The hæmoglobinurias and hæmoglobinæmias which Blacklock and Macdonald compare with blackwater fever are all associated with oxygen deficiency and, therefore, with lactic acid accumulation. With this as a basis for their argument the authors say :

"That some normal product of body metabolism such as lactic acid is involved in the hæmolytic process of blackwater fever appears probable from the facts which have been mentioned above. The etiological resemblance between blackwater fever and the other conditions in respect to anoxæmia has been shown. Now, in certain of these latter conditions it is assured that the cause of the hæmolysis is some natural product of the animal body; this is best seen in the experiments resulting in hæmoglobinæmia in normal dogs and in the observations on hæmoglobinuria in man caused by marching, where hæmoglobinuria is induced simply by exercise. It appears, therefore, essential to investigate what hæmolytic properties lactic acid possesses."

Blacklock and Macdonald conducted experiments in which they used pure sodium and ammonium dextrolactate and dextrolactic acid itself. The salts were found to be nonhæmolytic to human red cells

in vitro, while the acid itself was hæmolytic to washed red cells in saline solution. As washed cells might differ from whole blood, the investigators then tested the acid on citrated human blood and found that in dilution of 1 to 400 hæmolysis occurred. They then injected various amounts of sarcolactic acid of different strengths into the blood stream of rabbits and found that hæmoglobinæmia and hæmoglobinuria were produced. As a result of these findings they say :

"To summarize our results so far, we have shown that there exists between blackwater fever and certain allied conditions the common factor of deficient oxygenation; we have illustrated how this deficient oxygenation gives rise to the production of lactic acid; and finally we have shown that lactic acid is hæmolytic *in vitro* and *in vivo* in doses well borne by the animals.

"The foregoing facts make it probable that lactic acid is the hæmolytic agent responsible for the production of blackwater fever as well as for certain allied hæmoglobinurias. The anæmia produced by chronic malignant malaria, the stasis in the circulation of such an organ as the spleen brought about by the agglutination of parasitized red cells, and the frequently observed venous thrombosis result in a considerable degree of local anoxæmia and lactic acid accumulation. * * *

"If we now find that the main exciting causes of blackwater fever are such as will produce contraction of the spleen, already enlarged in volume and choked with parasitized red cells, we may conclude that the circulation in the spleen will be thereby still further impeded and that the local anoxæmia will be increased."

It has been shown that exertion or chill, or both combined, is the commonest exciting cause of blackwater fever. It has also been shown that exercise and chill cause contraction of the spleen. The other frequent exciting cause of blackwater fever is quinine, and Roth has demonstrated that quinine causes contraction of the spleen. The three common exciting causes of blackwater fever, then, have one thing in common—all cause contraction of the spleen. This, as has been said, increases the anoxæmia, which, in turn, causes more lactic acid to form. Finally, the lactic acid reaches such concentration as to cause hemolysis, and hæmoglobinuria occurs.

Hæmoglobinuria rarely occurs during the first six months of residence in an endemic area because, according to the authors, not sufficient time has elapsed for the anæmia to reach a severe stage nor for the spleen to become greatly enlarged. On the other hand, the relative freedom of old residents from blackwater fever may be accounted for by the fibrotic changes which have taken place in the spleen, these preventing contraction. Also there is an acquired tolerance to the parasite.

When a blackwater fever patient is moved he makes every effort to avoid pain and discomfort. He, therefore, contracts his muscles continually, thus producing lactic acid in excessive amount. This, if the authors' theory is correct, might account for the relapses which so frequently follow moving these patients.

RESEARCH IN YELLOW FEVER

In the *Annals of Internal Medicine* of August, 1928, appears the paper on this subject read by Aristides Agramonte before the American College of Physicians in March, 1928. Any article by this author on the subject is of particular value because of his widely accepted authority following the memorable experiments by him and his associates, Reed, Carroll, and Lazear in 1900 and his work on the etiology of yellow fever since that time.

In this article he has given a most interesting and careful account of the history of the disease and the views held at various times as work of the several investigators progressed.

Although the transmission by an insect was suspected and the theory held by several observers even as far back as 1853, the idea did not become an established fact until the experiments at Camp Lazear in 1901. Louis D. Beauprethuy, a French physician in Venezuela, declared in 1853 that transmission directly from man to man was impossible. He believed in the transmission by mosquitoes but thought that the mosquito acquired the infection by feeding on organic matter in stagnant waters.

The insect transmission theory gained great strength after the discovery by Manson in 1879 that filaria was an insect-borne disease, and the additional knowledge about insect transmission that resulted from the work of Theobald Smith on tick fever, and that of Ross and the Italian workers on the mode of transmission of malaria.

In tracing the views and claims held from time to time in regard to the causative agent in yellow fever, the author's account of the stir caused by the claims of certain charlatans from 1880 to 1900 is highly amusing. Major Sternberg showed the fallacies of the claims of Domingos Freire and Carmona y Valle in 1885, and in 1899 Agramonte exploded the "Sanarelli boom" that had lasted about two years following Sanarelli's "discovery" of his bacillus icteroides. Agramonte found the same organism in cases who had never had yellow fever and showed also that the organism was not agglutinated by the serum of yellow-fever patients.

As a result of the experiments at Camp Lazear in 1901 the conclusions of the board, which have never since been controverted, were:

1. That yellow fever is transmitted by the sting of mosquitoes now called *Aedes aegypti*.

2. That the mosquito becomes infected only when it stings the yellow-fever patient during the first three days, possibly four days, of the disease.

3. That the mosquito becomes infective only after the tenth day, in winter probably the twelfth day, of taking the blood from the yellow-fever patient.

4. That the period of incubation in man does not extend beyond six days.

The organism is still unknown despite the commendable work of Beyer, Pothier, and Parker in Vera Cruz (1902), Seidelin in Yucatan (1911), and Noguchi in Ecuador, Mexico, and Brazil (1919 until his death from yellow fever in 1928).

Agramonte believes the *Leptospira icteroides* is a "twin brother" of the leptospira of Weil's disease and thinks it will soon disappear from further consideration in connection with the etiologic factor in yellow fever.

TREATMENT OF MALARIA WITH PLASMOCHIN

Quinine has been a satisfactory specific, but since it often fails in preventing relapses and makes for a slow process in killing the gametes of carriers, plasmochin has claimed much attention as a mode of meeting these problems.

William Krause, writing in the Journal of the Southern Medical Association of September, 1928, reports his experiences with the drug at the Memphis General Hospital. He states that while gametes persist for weeks under intensive quinine treatment, he never found them after nine days' continuous treatment with plasmochin. Quinine is more effective in controlling the fever, but plasmochin is well tolerated by many patients who refuse quinine because of real or alleged idiosyncrasies.

The drug is doubtless a valuable addition to our armamentarium, especially in the field of preventive medicine; and while many writers stress the point of its toxicity, Krause found no trouble when a dose of one-third grain three times daily was not exceeded.

In the same journal, William E. Deeks concludes that "plasmochin is mainly effective against gametocytes in the peripheral blood, thus rendering the human carrier noninfectious to mosquitoes. Plasmochin, however, produces toxic symptoms in some individuals, which circumscribes its usefulness."

Those interested in the literature on plasmochin will find many excellent articles in the annual report of the medical department of the United Fruit Co. for 1927. That report contains a paper by

Wilhelm Cordes, who in treating 250 patients with plasmochin, observed 6 cases of intoxication, 2 of whom died. Four cases occurred after 8 centigrams and 2 after 4 centigrams of the drug was given daily for four or five days. He believes that plasmochin causes destruction of red blood cells and irritation of the hematopoietic system, with clinical symptoms of prostration, paleness, and jaundice, the intoxication resembling in certain aspects blackwater fever.

B. M. Phelps, also writing in the United Fruit Co. report, believes that plasmochin is a dangerous drug, but thinks that in combination with small doses of quinine it "will be our most advantageous method of treatment."

UNDIAGNOSED RENAL HEMATURIA

The recent tendency has been toward more and more conservatism in the treatment of undiagnosed renal hematuria; and that there is such a condition as real essential hematuria is becoming more widely accepted.

J. Hoy Sanford, writing in the Southern Medical Journal of September, 1928, on "Conservative urology in certain renal lesions," states that "we have advanced in our conservative attitude in this type of renal hematuria in that we do not nephrectomize these patients now so ruthlessly as in the past." Reasons for this are:

- (1) Refinement in diagnostic technic.
- (2) Previous experience of finding no pathology in removed specimens or the finding of a nephritis which doubtless exists in the remaining kidney.
- (3) The frequent disappearance of this condition after pelvic lavage and other procedures.

An excellent analysis of cases of essential hematuria at the Mayo clinic may be found in the Journal of the American Medical Association of February 25, 1928. This analysis and discussion is by H. C. Bumpus, jr., whose attitude is evidently much the same as that of Sanford on this question.

Normal pyelograms are the best evidence of the absence of such conditions as early tumor or renal tuberculosis. A repeating of the pyelograms at certain intervals is necessary, however, to avoid missing a tumor or tuberculosis that may become apparent at a later date.

THE SEDIMENTATION TEST IN UROLOGY

The recent literature has contained many contributions on the sedimentation test in all branches of medicine, but no publication on the application of the test to urology had appeared by an Ameri-

can author until that in the *Journal of Urology* of August, 1928, by Heinrich L. Wehrbein.

For the technique of the test one may refer to the detailed description of this given by E. G. Hakansson, lieutenant commander, Medical Corps, United States Navy, in his article in the *BULLETIN* of July, 1928.

Wehrbein states that the test "has two fields of application in urology, namely, as an aid to diagnosis and as a criterion of the degree and the course of the disease."

Although diagnostic puzzles have become rather rare in urology with the development of the diagnostic technique in that field, the sedimentation test has been of considerable help in many enigmatic cases cited by the author. Among these cases are:

That of an apparent hematocele showing marked acceleration of sedimentation. This proved to be a malignant tumor of the testis with free blood in the cavity of the tunica vaginalis.

A case of pain in the right kidney region, cystoscopically negative and the prognosis not considered serious. There was an almost maximal acceleration of sedimentation. The patient died five weeks later and autopsy disclosed a carcinoma of pancreas with metastasis.

A case of pain in the genitalia, frequency, and dysuria. Cystoscopy negative and sedimentation normal. The symptoms proved to be due to a psychosis.

A case of bladder tumor removed and diagnosed histologically as papillary epithelioma. There was only a very moderate acceleration of sedimentation. Nine months after operation the bladder was quite normal.

In several hundred observations on urological cases the author has concluded that "a normal or nearly normal sedimentation velocity almost definitely rules out malignant disease, active tuberculosis, and acute pyogenic infection," and that "the degree of acceleration is nearly always in proportion to the degree of active pathological involvement."

He believes that the numerical expression of the test should not replace the clinical picture, but that "such figures will serve as an efficient check against therapeutic enthusiasm or possibly as a convincing proof of therapeutic efficiency."

VAS INJECTION

A report upon results obtained by this method of treatment has been made by Theodore Baker in the *Journal of Urology* of August, 1928, in a paper entitled "The Value of Vas Injection in Chronic Genital Infections Based Upon a Series of 75 Cases." These cases

presented symptoms which had existed from six months to many years and were, in order of frequency: Persistent or recurring urethral discharge, acute or recurring attacks of epididymitis, referred pains, arthritis, and general impairment of health. These symptoms were caused by seminal vesiculitis and prostatitis. Fourteen of the cases were nonvenereal in origin. Ten to twenty cubic centimeters of collargol—5 to 10 per cent—were injected into the vesicles. The cases are divided into four classes, according to duration of symptoms. Rapid cure without further treatment was noted in from 30 per cent (in the 1 to 2 year class) to 61 per cent (in the 2 to 5 year class). The number of cures was increased by further treatment, such as massage, sounds, and irrigations, to from 38 per cent (in the 1 to 2 year class) to 76 per cent (in the 2 to 5 year class). In the class of five years or over, which included 14 cases, 5 of the cases were apparently cured by the injection alone. Seven others of this class recovered after further treatment.

The author concludes that "medication of the seminal vesicles by vas injection is efficient in effecting a cure in perhaps 40 per cent of cases of chronic genital infection," and that "an equal number of cases will require prostatic massage, sounds, irrigations, etc., because of conditions other than seminal vesiculitis."

TREATMENT OF GONORRHEAL EPIDIDYMITIS

Few indeed are the medical officers who are not always ready and eager to enter a discussion on the relative merits of the various methods of treatment for gonorrheal epididymitis.

In the *Journal of Urology* of August, 1928, appears an article by Eric Stone entitled "Comparison of the Results of Various Treatments for Acute Gonorrheal Epididymitis." The report is based on an analysis of 215 cases. Three bases of comparison were used for evaluating the effectiveness of the various kinds of treatment, namely, (1) time required for relief of pain, (2) time confined to house or hospital, (3) time required for involution of the epididymis. One hundred and twenty were treated by expectant treatment alone. In 25 other cases expectant treatment failed and other methods were required. Fifty-one cases were treated by epididymotomy, 17 by intravenous mercurochrome, 9 by diathermy, 8 by aolan, 4 by intravenous sodium iodide, and 1 by intravenous calcium chloride.

Unfortunately the series treated by other than the expectant method and by epididymotomy were rather too small for use in forming any definite conclusions as to the values of these methods. The cases treated by diathermy were selected cases, being all in the

first day of the attack when treatment was begun, and none was in great pain. Treatment was given by means of the Corbus Bipolar Scrotal Electrode. Except in one instance all the cases receiving diathermy continued their work. In one case no relief of pain was felt after the first treatment by diathermy, and an epididymotomy was done.

The author concludes that—

Expectant treatment alone is inefficient.

Epididymotomy gives immediate relief of pain in many cases and in most cases earlier relief than any other form of treatment. It shortens the time of incapacity and the time of involution more effectively than other types of treatment.

Sodium iodide gives no better results than expectant treatment alone may be expected to give.

Aolan is very effective in shortening the time of incapacity.

Diathermy may obviate any incapacitation in selected cases, but shows poor results in regard to involution.

WASSERMANN-FAST SYPHILIS

“Whether there is a correlation between the so-called Wassermann-fast phenomenon and the existence of active syphilitic processes in patients who exhibit this phenomenon is a question which has never been fully answered.”

Llewelyn Williams Lord has so stated the question, and has also attempted to answer it in his paper read before the Southern Medical Association and printed in the Southern Medical Journal of August, 1928.

The study is based on the observation of 118 patients at the Johns Hopkins Hospital who showed persistently positive reactions after one year of intensive treatment. The duration of the disease when treatment was begun in this series varied from 1 to 30 years. Those with neurosyphilis made up the largest class of this series, with the cardiovascular and bone syphilis classes following.

The methods used to determine the presence of active disease were those of spinal-fluid examinations and the noting of recurrence of symptoms after treatment had been abandoned.

In 47.5 per cent of the cases it was possible to prove active syphilitic disease in spite of one year or more of regular and active treatment. In 49 per cent serious damage was demonstrated although the activity of the disease could not be proved beyond a doubt.

Facts brought out in the study supplied evidence tending to support the conception that Wassermann-fastness depends on the persistence of the infection.

TREATMENT OF NEUROSYPHILIS BY "INOCULATION MALARIA"

Because of the remissions so frequently seen in untreated paretics, studies on the value of various methods of treatment were of no great importance until these methods were put to the test of several years' time. Records are now available covering a period of six years during which time the malaria method of treatment has been in extensive use. The reports have gained greatly in value during the last two years and now the very decided efficiency of the malaria treatment is quite obvious.

In the *Journal of Nervous and Mental Diseases* of August, 1928, Philip B. Matz has reported on 346 Veterans' Bureau patients who were treated by inoculation malaria. These patients were under observation for an average period of 27 months, the longest period being 47 months. In this series the malaria treatment was followed by antisyphilitic treatment.

Without entering the matter of contraindications and complications discussed at length by the author, the results he reports were briefly as follows:

Of the 346 patients treated, 24 per cent were greatly improved, 41 per cent improved, 23 per cent remained unimproved, 7.5 per cent became deteriorated, and 3.5 per cent died.

The cytology of the spinal fluid showed a favorable change in 81.7 per cent of a series of 279 cases under observation, the fluid Wassermann became negative or modified in 59.8 per cent, and the colloidal gold curve was modified in 54.5 per cent.

DIABETES

The clarity and accuracy of our concept of any disease are always increased by detailed knowledge of the many factors concerned in that disease, and this is reached only by detailed observations on a large series of cases.

Henry J. John has thus made an important contribution to our knowledge of diabetes by his statistical study of 2,000 cases at the Cleveland clinic. He has reported his observations on this large series in the *Archives of Internal Medicine* of August, 1928.

In summary, his findings are:

1. Among all diseases seen at the Cleveland clinic, the incidence of diabetes was 2.28 per cent.
2. The incidence increases with each decade of age, except that it is higher in the sixth than in the seventh decade.
3. There is a hereditary history in 5.3 per cent and a familial history in 4.5 per cent of cases.

4. Glycosuria was found in many diabetic persons with normal blood sugar (in 159 patients with blood sugar below 180 and in 26 patients with blood sugar below 120). On the other hand, glycosuria was not present in many patients with high blood sugar, the highest blood sugar level without glycosuria being 390 milligrams per 100 cubic centimeters.

5. The general belief among the laity that insulin once used must always be continued is shown to be fallacious.

6. The blood sugar response to insulin varies widely in different patients and from day to day in the same patient.

7. Insulin reactions are not wholly due to hypoglycemia, but are found fairly frequently in the presence of hyperglycemia, as noted in one case in which the blood sugar at the time of the insulin reaction was 467 milligrams per 100 cubic centimeters.

8. There were 85 cases of coma in this series. Of these, 81.35 per cent lived and 18.85 per cent died. In these cases the blood sugar on admission ranged from 200 to 1,664 milligrams per 100 cubic centimeters.

9. The total mortality in the entire series of 2,000 (over a period of nearly seven years) was 6.55 per cent.

10. There were 221 major operations performed on patients in this series. The mortality of the surgical cases was 12.66 per cent.

11. The incidence of syphilis was 2.7 per cent.

STREPTOCOCCUS CARDIOARTHRITIDIS

In the April, 1927, number of the BULLETIN attention was called to the discovery by J. C. Small of an organism which he believed to be the causative agent in acute rheumatic fever and chorea, and to which he gave the name *Streptococcus cardioarthritidis*. Since that time, Small and his coworkers in Philadelphia have carried on much experimental work with the organism and have reached certain definite conclusions concerning it.

The June, 1928, number of Annals of Internal Medicine, contains a paper by Small which was read by him at the 1928 meeting of the American College of Physicians. In it the author reports the results of his further studies with the organism.

According to Small, the *Streptococcus cardioarthritidis* is found regularly in throat cultures of patients with rheumatic fever or chorea and has been isolated from the blood in three cases of rheumatic fever. Cultures have been received from England and the organism has been identified in Syria.

In rabbits and horses, lesions resembling those of rheumatic fever have been produced by inoculation with the organism, and agglu-

tinins have been demonstrated in the blood serum of patients with rheumatic fever and chorea.

It would seem, then, that the specificity of the organism has been established.

The antiserum of *Streptococcus arthritidis* has been used for treatment in 251 patients and improvement has followed promptly in cases of chorea and rheumatic fever. All symptoms of rheumatic fever are alleviated and the twitchings of chorea usually cease within a week.

The passive immunity afforded by the serum seems to last from four to five weeks only, so it is necessary to begin active immunization at an early stage.

Small doses of the vaccine prepared by Small may produce very severe reactions in persons with deep-seated rheumatic infections, and relapses of rheumatic fever have followed large doses, whereas suitable doses in subacute cases remove the symptoms.

The antiserum is prepared in horses and cattle and the two types seem to be equally effective, but the bovine type is less liable to provoke serum sickness.

The lots of antiserum tested vary greatly in their strength as is shown by the necessity of using amounts varying from 25 cubic centimeters to 200 cubic centimeters in order to bring about like clinical response. The equine type has now been concentrated so that the dosage is from 10 to 20 cubic centimeters. Concentration of the bovine type is under way.

Hypersensitiveness may be guarded against by intradermal skin tests and the "local inflammatory reaction of immunity" may be avoided by giving broken doses subcutaneously or intramuscularly. Not more than 5 cubic centimeters of the concentrated antiserum should be given as a first dose.

Because of the dangers attendant upon the use of vaccines, soluble products of the microorganism are used to produce active immunity. These—known as soluble antigen—act similarly to vaccine in bringing about immunity. This "soluble antigen" is a saline extract of the bacteria and is used in dilutions of 1 to 10,000 and 1 to 1,000, the initial dose of the former being not more than 0.1 cubic centimeter subcutaneously. Subsequent dosage is so regulated that "an injection will not excite severe local reactions lasting five days or more; so that no febrile reactions occur; so that a persistent acceleration of pulse is avoided; and so that the patient does not lose body weight while under treatment."

The soluble antigen may be used as a diagnostic test in patients with chronic arthritis. Those in whom the arthritis is due to chronic rheumatism will show a marked general and focal reaction following

the injection of 0.05 or 0.1 cubic centimeter of the 1 to 1,000 soluble antigen.

Small's work still requires further confirmation by others, but it seems reasonable to believe that a great step forward has been made in the therapy of the rheumatic conditions.

LIVER EXTRACT IN PERNICIOUS ANEMIA

Since the feeding of liver was first found to be effective in the treatment of patients with pernicious anemia, effort has been made to discover the nature of the substance responsible for the beneficial effects and to perfect methods for its isolation. Further efforts have been made to standardize the treatment and to find means whereby the amount of liver substance, or of the active principle, necessary to maintain the patient in health might be determined.

It has been found that the active principle is not protein, carbohydrate, nor lipid, nor is it one of the known vitamins. It is probably a nitrogenous base or polypeptid.

In the laboratories of physical chemistry of the Harvard Medical School methods for the preparation of liver extract were first evolved. These have been modified so as to allow the manufacture on a large scale of the extract by Eli Lilly & Co., whose product, known as liver extract No. 343, has been accepted as suitable for general distribution by the committee on pernicious anemia.

Under the title "Treatment of Pernicious Anemia with Liver Extract: Effects Upon the Production of Immature and Mature Blood Cells," Minot, Cohn, Murphy, and Lawson report, in the May, 1928, number of the American Journal of the Medical Sciences, the results of their study of 160 cases of pernicious anemia who were treated with liver extract. Of these, 89 were treated with the standardized liver extract No. 343.

The authors summarize their report as follows:

The experience gained from the treatment of over 160 cases of pernicious anemia by the daily feeding of adequate amounts of potent extracts of liver is recorded. Extracts containing the active principle effective in pernicious anemia, which acts specifically in small amounts, have simplified treatment. Treatment with potent extracts not only causes rapid blood regeneration, but appears to check the progress, or causes to vanish, certain signs and symptoms of the disease not directly related to the state of the blood or the blood-forming tissues.

A standardized extract of liver has been employed, which given daily in such amounts as are derived from 300 to 600 grams of liver (from 9 to 18 grams of the extract), has caused with regularity, prompt and striking improvement in the health of 89 patients. Similar results have been obtained in over 70 other cases treated with differently prepared fractions of liver. Serious complications may prevent improvement.

Both the percentage and absolute numbers of reticulocytes in the peripheral blood at the peak of their rise are related to the level of the red blood corpuscles at the time treatment is begun. These relations may be employed to help determine the potency of material fed a patient.

Up to the peak of the reticulocyte rise the increase in the concentration of total red blood corpuscles may be ascribed almost entirely to the production of reticulocytes when the red blood cells are less than 2.8 million per cubic millimeter.

In cases with over 3,000,000 red blood cells per cubic millimeter or in cases which have received daily maximal amounts of potent extract for over 12 days, the increase in the total concentration of red blood cells is dependent chiefly on the liberation from the bone marrow of mature corpuscles.

In pernicious anemia with less than 3,000,000 red blood cells per cubic millimeter, the absence of a reticulocyte response renders it exceedingly probable that an impotent extract has been employed. On the other hand, if the extract given is known to be potent, and no distinct reticulocyte increase follows, it is very improbable that the patient has pernicious anemia, provided his red blood cells are below 3,000,000 per cubic millimeter.

The number of reticulocytes that appear in the blood at the peak of their rise is roughly proportional to the amount of active principle ingested daily, provided submaximal amount are fed to patients with less than 2,500,000 red blood cells per cubic millimeter. When large amounts are given the reticulocytes are apt to appear sooner and vary more in concentration in different cases with the same erythrocyte level.

In some cases there are probably many primitive cells to be transformed within the marrow and in others relatively few, so that in the latter more reticulocytes would not enter the blood stream even if more active principle were given. Standardized extract from 500 or 600 grams of liver apparently is sufficient to produce a maximum response of young red blood cells in essentially all cases.

There is a direct relationship between the rate at which the red blood corpuscles increase and the amount of potent material fed, up to a maximum. On the average, when liver extract derived from 500 to 600 grams of liver has been fed daily to patients with less than 2,000,000 red blood cells per cubic millimeter of blood, it has increased the concentration of these cells about 2,500,000 per cubic millimeter in 30 days. After two months of adequate therapy with liver extract red blood cell counts in the vicinity of 5,000,000 per cubic millimeter are to be expected.

The patients treated with liver extract have been given an adequate well-balanced diet containing no liver or kidney. The striking and rapid symptomatic improvement has been comparable to that reported for cases treated with whole liver.

The active principle effective in pernicious anemia appears particularly to stimulate the formation of red blood cells. The return to normal of red blood corpuscles usually proceeds more rapidly than that of hemoglobin as the result of treatment with liver, with kidney, or with liver extract.

The hemoglobin increases perhaps more slowly in cases treated with liver extract and a diet poor in sources of iron and in foods that accelerate hemoglobin regeneration than when potent extracts are given and the diet is well balanced and rich in such foods.

It is emphasized that the continued ingestion of some source of the active principle effective in pernicious anemia is necessary to prevent relapse in this disease.

ALCOHOLISM

As an aid in determining the degree of intoxication in persons suspected of drunkenness, Dr. Emil Bogen, in the August, 1928, *American Journal of the Medical Sciences*, advocates an estimation of the amount of alcohol present in the urine, breath, or body fluids. This is not to take the place of the usual tests for drunkenness, but is to supplement them.

The examination is made by passing a current of air containing the alcohol in gaseous form through Anstie's reagent, a solution of two-thirds of 1 per cent of potassium bichromate in concentrated sulphuric acid. The color changes from reddish-yellow to greenish-blue, depending upon the amount of alcohol present. A set of standards for comparison consists of 5 cubic centimeter portions of the reagent to which known quantities of alcohol have been added.

In the case of urine or other fluids 1 cubic centimeter of the specimen is placed in a test tube and a purified current of air is passed through it into 5 cubic centimeters of the reagent mixture for 10 minutes, both tubes being immersed in a boiling water bath.

In order to estimate the alcohol content of the breath the suspect is requested to blow up a football having a capacity of about 2,000 cubic centimeters. This air is then bubbled through 5 cubic centimeters of the reagent. If the person upon whom the test was being made was unable or unwilling to blow up the football, Bogen applied a mask with a 2-way valve, and thus accomplished his purpose.

The Ohio courts have held that a person can not be considered intoxicated unless he has "lost either the control of the faculties . . . or of the muscles of locomotion." In Bogen's study of 500 cases no diagnosis of acute alcoholism was made unless the patient showed loss of control and coordination in addition to mental disturbance and the odor of alcohol on the breath.

The group showing from 0 to 1 milligram of alcohol in 1 cubic centimeter of urine comprised 35 individuals. None of these was found to be intoxicated, although about one-half of them admitted drinking.

A little more than one-half of those showing from 1 to 2 milligrams of alcohol in 1 cubic centimeter of urine were diagnosed "acute alcoholic intoxication."

Of the group showing from 2 to 3 milligrams the definite diagnosis was made in two-thirds. About one-fourth of this group were able to stand straight and talk clearly, while 15 per cent were unable to stand or talk.

Of those whose urine contained from 3 to 4 milligrams of alcohol per cubic centimeter, only a few were not definitely drunk. Only

3 per cent could stand without marked swaying and only one could speak clearly.

All patients with more than 4 milligrams of alcohol per cubic centimeter of urine were unconscious. These were the "dead drunks."

Bogen says that if the concentration should reach 6 milligrams or more, death would be likely to follow.

The concentration of alcohol in the urine depends somewhat upon the time the specimen is obtained with reference to the time of drinking. The concentration in the breath, however, follows very closely the concentration in the blood, so is a more accurate index of true conditions.

Less than 16 per cent of those persons having less than 1 milligram of alcohol in 2,000 cubic centimeters of breath were found to be intoxicated. In those with from 1 to 2 milligrams of alcohol in the same quantity of breath, one-half were intoxicated. More than four-fifths of those with from 2 to 4 milligrams and all of those with more than 4 milligrams were pronounced intoxicated.

The alcoholic content of the spinal fluid follows very closely that of the urine.

Bogen concludes "that the alcoholic concentration of the urine, breath, or body tissues constitutes the most reliable single factor in arriving at a correct diagnosis of the degree of acute alcoholic intoxication of a patient."

In the same issue of the American Journal of the Medical Sciences, J. L. Richardson and M. A. Blankenhorn, of Cleveland, write on the New Clinical Aspects of Alcoholism. Their paper is based upon a study of 198 cases of alcoholism treated at the Lakeside Hospital from 1921 to 1926, inclusive, special attention being paid to the differences between the symptoms of alcoholism in these days of "bootleg liquor" and those of the same condition before prohibition went into effect.

A larger proportion of patients suffering from acute alcoholism are brought into the hospital unconscious than was formerly the case. Also, most cases nowadays are mildly febrile, while formerly a sub-normal temperature was generally expected. A large number of cases now show a transient albuminuria, whereas before prohibition this was rare.

In these days unusual complications are not rare, probably because of poisonous substances in much of the liquor drunk.

Delirium tremens is less common than in preprohibition days, and this the authors attribute to changed habits of the chronic alcoholic. Whereas formerly the chronic alcoholic was a daily "tippler," he now indulges in frequent sprees when he can obtain a supply.

EPIDEMIC ENCEPHALITIS

Lloyd H. Ziegler, M. D., of Rochester, Minn., has conducted "follow-up studies on persons who have had epidemic encephalitis" and published his findings in the *Journal of the American Medical Association* of July 21, 1928. The summary of his studies follows:

"Seven hundred and fifty-two patients who had had epidemic encephalitis for an average of five and a half years were traced. The occupation, age, and sex did not apparently bear any relationship to the severity of the disease. Other factors were not discovered that would afford prognostic information. The disease tends to have its onset chiefly during the winter months. For the most part it is a progressive disease.

"The mortality rate for this group was 13.2 per cent and the recovery rate 1.3 per cent about five and one-half years (average) after the onset of the disease. Of the entire group of patients, 15.7 per cent are able to work regularly; 25.7 per cent are doing light or part-time work.

"Patients recover from severe acute attacks, from the respiratory symptoms, and from behavior and other residual sequelæ, but rarely, if ever, from the parkinsonian syndrome. Parkinsonian types may become arrested.

"Of drugs, scopolamine, by the testimony of many patients, is helpful. Probably next in importance is sodium cacodylate given as a tonic. These should be supplemented by good general care and removal of obviously active foci of infection. The vaccine used in the treatment was, as a rule, made from cultures from foci of infection; it was associated with lowered mortality, but otherwise the results from its use were similar to those from other therapeutic measures."

TEMPERATURE AND THE SEDIMENTATION RATE

As the blood-sedimentation test is coming into comparatively general use as an aid in diagnosis and prognosis, it is important that it be conducted under uniform conditions, so that reports of findings with it may be interpreted correctly. One most important requisite is that it be conducted at a standard temperature.

In the August, 1928, number of the *American Journal of the Medical Sciences*, Murray B. Gordon and David J. Cohn, of Brooklyn, have a paper entitled "The Effect of External Temperature on the Sedimentation Rate of the Red Blood Corpuscles."

These authors noted that on hot summer days the rate of sedimentation was greatly accelerated, so they conducted experiments to determine the constancy of this. Blood was mixed with 5 per cent

solution of sodium citrate and then divided into three portions. One portion was placed in a temperature of 10° C., another in a temperature of 23° C., and the third in a temperature of 37° C. They found that the sedimentation rate was accelerated by the higher temperature and slowed by the lower temperature. This effect they found to be transitory and not so lasting as the effect of prolonged heating. They therefore suggested that "a standard of 23° C. should be maintained for all such investigations. This adoption of a standard temperature is especially necessary for the comparison of the results of various investigators. Seasonal variations showing the effect of extreme heat in the summer and of cold in the winter must be taken into consideration in the interpretation of results, unless controlled by uniform standard experimental conditions."

NOVOCAINE IN THE REDUCTION OF FRACTURES

Day and Levenson, in the *New England Journal of Medicine*, July 12, 1928, report two cases of fracture of the wrist in which novocaine was successfully used in the reduction.

In one case, a Colles fracture, the wrist was painted with 10 per cent mercurochrome and 1 per cent novocaine was injected anteriorly and posteriorly into the line of fracture of the radius, about 1 cubic centimeter in each position. One-half cubic centimeter was injected into the region of the fracture of the ulna. Pain and spasm were relieved almost at once and reduction was accomplished in the usual way.

In the other case the technique used is not given, but the results were equally good.

The authors say:

"In the reduction of simple fractures, novocaine can be used quickly and it finds a real place where general anesthesia is not available or is contraindicated. The same anesthesia lasts about one and a half hours and more than one reduction is possible if X rays indicate it."

WORRY: CAUSES AND PREVENTION

An article of unusual clarity and interest by David S. Booth appears in the *Journal of the Missouri State Medical Association* of September, 1928. Most of us will agree with Doctor Booth that "worry is the most universal and distressing condition or phenomenon of civilization, since it is not confined alone to the afflicted but extends to the home . . . and spreads to the social sphere in which the afflicted moves."

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Worry is "a prolonged anticipatory dread or fear of subjective origin" arising "from the subjective feeling of inadequacy, but is usually projected externally and attached to inconsequential conditions of environment."

Fatigue, especially abnormal sorts of fatigue, play a rôle in causation that the physician is often able to deal with. The fatigue following acute illnesses, notably influenza, and in the tropics dengue, frequently give rise to a fear of being unable to meet the requirements of the future. Chronic infections resulting in a constant low-grade toxemia are accompanied by just this abnormal fatigue that results in worry. A search for infectious foci, the supply of rest, vacations, environmental changes, hobbies, and other interests are here more rational procedures than simply charging the trouble to the patient's bad disposition.

Insomnia and worry go together as causes and effects of each other, but overfatigue is a cause of both and a cause of further fatigue. Although Christians probably worry more than those of other sects, those of them who are fortunate enough to possess the virtues of "faith, hope, and charity" and have them as a settled philosophy of life, enjoy a certain immunity which the less faithful are not endowed with.

EXAMINATION OF FECES.—A RAPID METHOD FOR THE DETECTION OF PARASITIC OVA AND CYSTS

An excellent method for the concentration of ova and cysts of intestinal parasites in specimens of feces is described by D. Rivas in the *Journal of Tropical Medicine* (1928, viii, 1, 63); as follows:

1. Place 1 to 2 grams feces in a medium or large-sized test tube and add 5 cubic centimeters of 5 per cent acetic acid for each 5 gram of feces.
2. Stopper tube and shake until suspension is homogeneous.
3. Allow to stand one minute for coarse particles to settle.
4. Remove supernatant fluid with a pipette or, if necessary, filter through double layer of cheesecloth.
5. Place 5 cubic centimeters of filtrate in centrifuge tube, add an equal volume of ether; stopper and shake horizontally until homogenous (a few seconds).
6. Centrifuge for one to two minutes.
7. Pour off all but the sediment (which may be very scanty).
8. Mount and examine the sediment.

ANCIENT FALLACIES IN MEDICAL LITERATURE

In the *American Journal of Tropical Medicine* of September, 1928, appears the presidential address of Capt. C. S. Butler, Medical Corps, United States Navy, which was read before the American Society of Tropical Medicine in May, 1928.

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Doctor Butler has in this paper called attention to our frequent offense in having insufficient regard for facts discovered previously and recorded in the literature. He also points out the fault of failing to put a modern and sensible interpretation on the observations of ancient times, the descriptions of which have become distorted by being passed through various translations.

A poor observation or faulty method which may enter textbooks quickly and easily sometimes can not be removed for centuries. To illustrate this point he cites the tendency of a certain great fallacy to creep into our books; a tendency which, in this particular case, keeps somewhat current the highly fallacious idea that syphilis was introduced into Europe from the New World by Columbus's crews. If there are those who still have some doubt about this part of the history of syphilis, they can not do better than read this address, since it is impossible to read without losing beyond all peradventure any remaining bit of skepticism that one might have entertained in this regard. Still other modern myths are: That the savage practice of inoculating children with yaws will result in a more mild infection than one acquired by chance; that it may be unwise to conduct antiyaws campaigns since these may promote the spread of syphilis in yaws countries; and that a "yaws vaccine" may be developed which may be useful in immunizing against syphilis.

To epitomize what Doctor Butler has conveyed in his address, we should strive to be—

"1. As quick to apply long-known facts and principles as we are industrious to discover new ones;

"2. As much pleased to nail ancient fallacies as we are to shoot down modern ones; and,

"3. In the interest of the future student, as earnest in the desire for simplicity and clearness in our statements of medical facts and principles as the circumstances will permit."

AMERICAN COLLEGE OF SURGEONS

The American College of Surgeons each year heretofore has generously invited the Surgeon General to nominate a specified number of medical officers as candidates for fellowship in the college.

Assuming that the privilege will be extended to the Navy again this coming year, it is suggested that officers desiring to have their names considered for nomination submit their applications not later than July 1, 1929.

Although for officers of the Navy fellowship is made a matter of courtesy, it nevertheless seems proper that there should be presented as candidates only those officers who are fully qualified for fellowship

in accordance with the standards set by the college. Consequently it is the fixed policy of the bureau to stand sponsor for only those officers who, in the opinion of the bureau, meet the high standard of professional qualifications set by the college and who are prepared to comply with all the professional requirements imposed by the college on candidates from civil life. Should the number of qualified applicants exceed the number of nominees permitted, the order of selection will be according to relative merit.

To be eligible for fellowship without technical examination the candidate shall be a graduate, of at least seven years' standing, of a medical school approved by the American College of Surgeons.

The candidate shall give evidence that he has served at least one year as interne in an accredited hospital and two years as surgical assistant, or he shall give evidence of apprenticeship of equivalent value. As a means of furnishing precisely the information desired, it is requested that the "application for fellowship" (obtainable from the bureau) be filled out and submitted with the applicant's case reports.

Letters also may be submitted by the candidate testifying as to his personal traits as well as to his professional qualifications.

The professional activity of the candidate shall be restricted to the study, diagnosis, and operative work in general surgery or in special fields of surgery, such as eye, ear, nose, and throat, genito-urinary, orthopedics, and gynecology and obstetrics.

As evidence of his qualifications in the technique of surgery, the candidate is required to submit in complete detail, through official channels, the case records of 50 consecutive major operations which he has performed himself.

In addition to the complete records of 50 consecutive major operations, the candidate is asked to submit in brief abstract a report of at least 50 other major operations in which he has acted as assistant or which he has performed himself.

The senior medical officer with whom the candidate is serving, when forwarding these case records and the abstract of major operations in which the candidate has assisted, shall furnish, by means of an appropriate indorsement, his estimate of the candidate's qualifications for fellowship.

The attention of prospective candidates is invited to the desirability of having case reports typed on paper of cap size, suitably arranged and bound, and prefaced by both an index to cases (Form P) and a summary giving the total number of operations of each type; e. g., appendectomy, 14; cholecystectomy, 2, etc.

It is important further that each case be identifiable by recording (a) institution; (b) hospital number; (c) date; (d) initials.

AMERICAN COLLEGE OF PHYSICIANS

At a recent session of the American College of Physicians the board of regents adopted a resolution providing that candidates for membership from the Navy shall be proposed by the Surgeon General of the Navy.

The intent of the board of regents is to provide that all applications from officers of the Medical Corps of the Navy shall be forwarded through the office of the Surgeon General of the Navy, who will forward the applications to the college with a letter of indorsement. Candidates so proposed will be required to submit all the data and meet all the usual requirements for fellowship, and will be passed upon individually by the committee on credentials and the board of regents.

In addition to the indorsement of an application by the Surgeon General of the Navy, the board of regents requests also that the applicant fill in the names of three fellows of the college for reference.

Request for application blanks should be made to the Bureau of Medicine and Surgery.

RESIGNATION AFTER SPECIAL COURSES

In spite of frequent statements from the department to the effect that those officers of the Navy—medical as well as others—who receive the benefits of special courses of instruction are expected and should expect to render some adequate return to the Government for the money spent in furthering their education it is still a not infrequent occurrence for an officer to request the acceptance of his resignation shortly after completing his course. The policy of the department is to refuse such requests and to require such an officer to serve at least three years in the Navy after completion of any special course of instruction.

No postgraduate instruction will be given any officer unless agreement to remain in the service for a period of at least three years after completion of such instruction is incorporated in the officer's request.

In view of the repeated publication of this notice every officer may reasonably be expected to be cognizant of it. Consequently, notwithstanding the possible event of failure to submit an agreement in writing—owing to oversight or lack of time—the bureau will consider any officer accepting a course of instruction to be bound to serve as specified.

THE AMERICAN ASSOCIATION FOR THE STUDY OF GOITER

Dr. S. D. Van Meter, president of the American Association for the Study of Goiter, has extended a cordial invitation to naval medical officers to participate in the 1929 program of the association.

The next meeting of the association will be held in Dayton, Ohio, some time in March, 1929. Naval medical officers who attend will be welcomed.

ADMINISTERING TYPHOID PROPHYLAXIS

In the July, 1928, number of the *BULLETIN* a very useful, simple, and practical device for holding a large number of needles to be used in administering toxin-antitoxin or typhoid vaccine was described. This needle holder was devised by Dr. C. R. Hervey, of the New York State Department of Health, who very kindly presented one of the holders to the Navy.

Since publishing the description of Doctor Hervey's device, attention has been called to a somewhat similar needle rack which was devised by Chief Pharmacist's Mate T. R. Leonard, United States Navy, and a description of which was published in the April, 1926, number of the *HOSPITAL CORPS QUARTERLY*.

The medical officer of the Newport training station writes that Leonard's racks are still in use at that station and have been found very satisfactory.

The two devices differ in several respects, and we do not intend to infer that one is an improvement upon the other. The only object of this note is to call attention to Leonard's device and to give credit to the originator of so useful a piece of apparatus.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington, D. C.
(For review.)

TEXT BOOK OF SURGERY, by *W. Wayne Babcock, A. M., M. D., F. A. C. S.*
W. B. Saunders Co., Philadelphia, 1928.

This volume is a real contribution to surgical literature. In each short chapter the author has succeeded in condensing a very large number of facts and in so presenting them as to make them readily readable. He seems to have been able to leave out much that has been written into other textbooks on surgery of questionable value to the student or practitioner and to have put in its place much that illustrates surgical practice of this day and age. The volume should be an aid to diagnosis and a great help in determining the surgical treatment indicated. The chapter on the liver gives the attitude of present-day surgery toward the diseases of this organ in concise and complete form. The chapter on fractures places before the reader the facts in each type of injury that one must have in mind to institute intelligent treatment.

The style is that of a textbook. Its many paragraph headings make reference easy. The illustrations are accurate. They tell the story in a way that makes easy the application of the surgical principles enunciated to actual cases. If one's surgical library had to be limited to one book, this would best meet the need. Except for the surgery of the female pelvic organs, it seems completely to cover the field. In the opinion of the reviewer it is the best single-volume textbook of surgery that has yet appeared.

FRACTURES AND DISLOCATIONS, by *Kellogg Speed, S. B., M. D., F. A. C. S.*,
Associate Professor of Clinical Surgery, Rush Medical College; Associate Attending Surgeon, Presbyterian Hospital; Attending Surgeon, Cook County Hospital, etc. Lea & Febiger, Philadelphia, 1928.

In writing this second edition of his work Doctor Speed has rearranged his material and produced a book of great value.

The discussions of the various pathological conditions met in fractures are given with the text on the bones or joints involved. This gives in convenient form the data on a given fracture and includes all the types of treatment now advocated. Of special interest are the first three chapters, which deal with the general subjects of treatment of fractures, operative treatment of fractures, and dislocations. In less than a hundred pages the author has covered the salient points of this division of surgery and provided a concise résumé.

Each of the following 21 chapters is devoted to a surgical area.

The book is well written and is convenient for reference, there being an index of 30 pages.

THE TREATMENT OF DIABETES MELLITUS, by *Elliot P. Joslin, M. D., M. A.*, *Clinical Professor of Medicine, Harvard Medical School; Consulting Physician, Boston City Hospital; Physician to New England Deaconess Hospital.* Fourth edition. Lea & Febiger, Philadelphia, 1928.

The previous edition of this work was published when insulin therapy was in its infancy. After five years the profession feels insulin therapy is approaching stabilization. This is the author's reason for bringing out the fourth edition.

Doctor Joslin has been awake to the needs of checking on all forms of treatment that have been published and has actually tried out on his own patients the different forms of therapy. His results will be found in this book, as well as a comprehensive review of the literature.

The book contains 998 pages. It is complete in every detail, including prevention and treatment of complications. "Diabetes is no longer fatal, and the diabetic has ceased to die of his disease." Diabetics, however, are prone to complications that must be guarded against.

The work is highly recommended to the profession and especially to those treating patients suffering with diabetes mellitus.

DISEASES OF THE GALL BLADDER AND BILE DUCTS, by *Evarts A. Graham, M. D.*, *Professor of Surgery, Washington University, St. Louis, etc.; Warren A. Cole, M. D.*, *Instructor in Surgery, Washington University, St. Louis, etc.; Glover H. Copher, M. D.*, *Assistant Professor of Surgery, Washington University, St. Louis, etc.; and Sherwood Moore, M. D.*, *Professor of Radiology, Washington University, St. Louis, etc.* Lea & Febiger, Philadelphia, 1928. Price, \$8.

The subject covered by this book is one of extreme importance. The authors, the originators of cholecystography, have tried to give the reader a fair conception of the entire field of diseases of the gall bladder and bile duct, with the past and present methods of diagnosis and treatment. This volume is interesting and helpful to the general practitioner, the internist, the surgeon, and to the röntgenologist.

This is the first comprehensive discussion of the subject in the English language since Rolleston's classical work, *Diseases of the Liver, Gall-bladder and Bile Ducts*, published in 1905.

The book contains one well-prefaced chapter on anatomy, and another, most interesting, on the modern views concerning physiology of the gall bladder. There are given all of the tried methods, described in detail, that have proved to be aids in diagnosis. The newer methods of diagnosing disorders of the gall bladder are written in very plain language. While the authors are the originators of cholecystography, which has revolutionized diagnosis in this field, they maintain a critical attitude in evaluating it, but point out that much of the criticism directed against the method arises from a failure to understand the underlying principles, failure in proper interpretation, and poor technique.

There is an extensive review of the liver function tests in relation to the diagnosis of the gall-bladder diseases. The chapter on surgical treatment of cholecystitis is complete.

The book consists of 477 pages, with 224 engravings and 8 colored plates. It is a volume that completely covers the field in a thorough, conservative manner, and it is highly recommended to the medical profession.

GNOCOCCAL URETHRITIS IN THE MALE, by P. S. Pelouze, M. D., *Associate in Urology and Assistant Genito-urinary Surgeon at the University of Pennsylvania*. W. B. Saunders Co., Philadelphia, 1928. Price, \$5.

This work is written in a clear, concise style, the subject being handled completely and in well-ordered sequence. The author presents many of his own views. Undoubtedly some of these are radical departures from those usually accepted and will require further study. However, he states in his preface that if he be wrong at times there will be grounds for discussion and difference of opinion, and so aptly adds, "This is a disease that needs much more discussion." He is of the opinion that the symptoms of this disease are produced by the destruction of the gonococcus, which liberates an endotoxin which he calls the gonotoxin. He also takes up his work in connection with the production of a gonophage which acts similarly to the bacteriophage produced by d'Herelle. In considering the question of cure he emphasizes the production of mild local and systemic reactions, in contrast to the frequent attempts to bring about a cure by the use of strong antiseptics. The subject of treatment is taken up in much detail and many of its phases are at variance with the standard forms of treatment. The reviewer believes the author's views are well worth considering, because one too often sees cases of so-called chronic gonorrhea that are the result of

ignorance, neglect, or overzealousness. This is strikingly brought out in some of the case histories showing the haphazard and, at times, unjustifiable ways in which this disease is sometimes treated. It is believed this book would be of particular interest and value to the naval medical personnel.

AN INTRODUCTION TO EXPERIMENTAL PHARMACOLOGY, by *Torald Sollman, M. D., Professor of Pharmacology and Materia Medica at Western Reserve University, and Paul J. Hanzlik, M. D., Professor of Pharmacology at Stanford University.* W. B. Saunders Co., Philadelphia, 1928. Price, \$4.25.

The subject matter is arranged so as to be adaptable to the classroom and is presented in a practical and instructive manner. The book is divided into two parts, Chemical Pharmacology—Experimental Pharmacodynamics and Appendices. In the former there are given explanatory discussions of numerous experiments, the methods of conducting which are clearly described. The Appendices describe the necessary arrangements and equipment for animal experimentation; equipment of the chemical lockers of the students; reagents used; anesthesia; dilutions of drugs used in experiments with excised organs and for perfusions; physiologic salt solutions; isotonic solutions; etc.

This is a very satisfactory book for the purpose for which it is intended.

CRITERIA FOR THE CLASSIFICATION AND DIAGNOSIS OF HEART DISEASE, by a committee appointed by the Heart Committee of the New York Tuberculosis and Health Association, Inc. Paul B. Hoeber (Inc.), New York, 1928.

In this small volume of 92 pages an effort is made to outline the criteria for classification and diagnosis of heart disease in such a way as to secure uniformity in reporting such cases.

The criteria are given under several headings—etiological, anatomical, physiological, functional capacity, possible heart disease, and potential heart diseases—and the importance of including all factors in the diagnosis is shown. In addition enough data are given under each heading to enable the examiner to arrive at a conclusion as to how each case should be classified.

Study of this book by physicians will do much to clear up the confusion which now exists in the classification and diagnosis of heart disease, and, if all will follow the plan laid down in it, the task of compiling statistics on the subject will be rendered much less irksome.

This volume should be made readily available to all naval medical officers.

OSLER'S MODERN MEDICINE, reedited by *Thomas McCrae, M. D., Professor of Medicine, Jefferson Medical College, Philadelphia; Fellow of the Royal College of Physicians, London; Formerly Associate Professor of Medicine, Johns Hopkins University.* Volume VI. Lea & Febiger, Philadelphia, 1928. Price, \$9.

The first five volumes of this third edition have already been reviewed in the *BULLETIN*. Volume VI is devoted to diseases of the nervous system and diseases and abnormalities of the mind. Twenty of the leading minds in neurology and psychiatry of America and England are the contributors to this volume. It is thoroughly revised and brought up to the present moment in regard to the many recent advances in this field of medicine.

The latest refinements in spinal fluid examination for the diagnosis of the various types of meningitis, and also the significance of the fluid findings in regard to the course of the disease are ably discussed by E. Arnold Carmichael. The matter of topical diagnosis of diseases of the brain is treated in careful detail and at some length by Joseph Collins, who has also written the chapter on aphasia. Merely to mention that the chapter on intracranial tumors is written by Harvey Cushing leaves nothing to be said about the excellent way in which this final authority on the subject has treated it. He has also contributed the chapter on hydrocephalus.

L. Pierce Clark has disposed of many former erroneous conceptions of epilepsy and has with equal finality cast aside several ideas that have at various times been accepted in regard to treatment. One feels in reading what this authority has to say about treatment that he finds in these pages an accurate valuation of the different methods in use. He sums up in a sweeping manner and with a clarity which is striking, if we consider the usual vagueness of discussions on the subject:

To what end are all plans of treatment of the epileptic directed? Gradually we are widening our concept of the disease. Formerly we spoke of *epilepsy* and the *epileptic*; now the phrase is slowly being reversed; the *epileptic* and not the disease must be the main concern in treatment. It is increasingly held to be a disease process broadly interrelated with many other disordered functions of the whole organism, and finally, we may look upon it as a morbid modal behavior pattern of the organismic-environmental contact, as a sort of disease gesture of a peculiarly inferior adaptive mechanism.

The chapter on syphilitic diseases of the central nervous system by Bernard Sachs contains much that is new in regard to treatment, but the advances and changes in this field have been so great and so rapid during the past few years that the discussion in this volume unfortunately can not be said to be complete.

UROLOGY, by *Daniel Eisendrath, M. D., Attending Urologist, Michael Reese and Chicago Memorial Hospitals; Assistant Professor of Surgery (Genito-Urinary), Rush Medical College of the University of Chicago, and Harry C. Rolnick, M. D., Associate Urologist, Mount Sinai Hospital; Adjunct Urologist, Michael Reese Hospital; Formerly Associate in Genito-Urinary Surgery, Northwestern University Medical School.* J. B. Lippincott Co., Philadelphia, 1928. Price, \$9.

Before the advent of the cystoscope many if not most of the textbooks on urology were devoted chiefly to the subject of venereal diseases, which then included syphilis in all its branches and phases. The rapid and extensive advances in urology during the last 10 years have so broadened its field of application that syphilis, except in its strictly primary and venereal aspects, no longer belongs in a urological text and is much more fittingly considered in such works as those on syphilology, internal medicine, neurology, and other specialities.

Likewise, the other venereal diseases can no longer occupy the major part of a textbook on urology. But there is no doubt that recent authors have gone too far in this reaction and in their enthusiasm to stress the surgical side and the upper urinary tract have neglected to give the proper space and importance that is due the genital tract and the venereal diseases.

Until the appearance of this book none has been seen in which the subject has been presented in a fairly simple manner and in which the various topics have been allotted space and importance in the order in which the practical problems of these matters are apt to confront the urologist and the general practitioner. There has not been before any textbook on urology so expertly "balanced" in this respect. To recite a case at the other extreme, there is a treatise on urology in two huge volumes which do not contain a word on the subjects of sterility and impotence, a most trying and very frequent problem that the urologist must meet.

Recent literature has given much attention to the prostate and seminal vesicles as foci of infection resulting in systemic and rheumatic disorders, and has recognized that the most vicious and persistent of these infections are often nongonorrheal in character; the colon bacillus and staphylococcus being the offenders.

For students and for general practitioners no better book could be found for acquainting themselves with such matters as the anatomy and physiology concerned, instruments and methods of examination, and methods of anesthesia. Illustrations and diagrams are plentiful and are as helpful as the unusually clear descriptions.

The chapters on gonorrhea leave nothing to be desired. The importance of conservatism in treatment is well stressed.

The chapter on seminal vesiculitis incorporates all the ideas of Belfield, is unusually complete, and goes thoroughly into such valuable methods of treatment as vasotomy and the use of the arsphenamines.

The chapter on sexual impotency and sex neuroses has been written by Irvin S. Koll, and readers will be gratified to find that he has done this with admirable clarity and conciseness without omitting from consideration any feature of importance.

The chapters on prostatic hypertrophy, the upper urinary tract, and surgical procedures involved occupy about one-half of the book and are not excelled in such a happy combination of simplicity and comprehensiveness both as to description and diagrams.

RHEUMATIC DISEASES, A COLLECTION OF 50 PAPERS READ BEFORE THE CONFERENCE ON RHEUMATIC DISEASES HELD AT BATH, ENGLAND, IN MAY, 1928.—Published by the Hot Mineral Baths Committee of the Bath City Council, 1928.

The old Roman city of Bath, England, known in early times as *Aquae Sulis*, was a famous health resort as early as the first century. The oldest portion of the unique group of buildings now in use for the treatment of various rheumatic disorders dates from 54 A. D.

It was very fitting therefore that this spot should be chosen for the assemblage of many of the leading minds of the world interested in this subject, in May, 1928, for the discussion of the problem of rheumatic diseases.

Out of that conference has come this set of papers, which is a collection of the opinions and advice of the most expert authority one could find available for reference to-day.

The papers are grouped in the book into three sets: (1) Those dealing with social, industrial, and general aspects of the question, (2) those concerning etiology, and (3) those devoted to the matter of treatment.

This disease is evidently more prevalent in England than America. In England in 1927 one-seventh of the whole amount paid out by the national health insurance scheme was for rheumatic diseases. About \$25,000,000 in insurance was disbursed because of these diseases and an equal amount was lost in wages. The condition is now responsible for some 20,000 deaths annually from heart disease in England. Dampness and poverty, it is agreed, are contributing causes of a national character, and these are found to a greater extent in England than in the United States.

Vice Admiral Gaskell, director general of the medical services of the British Royal Navy, states that there has been in recent years a marked decline in the incidence of this disease in the British Navy, and attributes this decline to such factors as less crowding, better ventilation, better care of teeth and tonsils, and better diet.

Under etiology, unfortunately, the difficulty arises of considering more than one disease, and attempts to correlate such a condition as acute rheumatic fever with such conditions as arthritis deformans and the various myalgias result in much confusion. The acute infec-

tious disease is the one chiefly under discussion in these papers and frequently the very apt term "cardio-arthritis" appears. Several authors emphasize that it must be thought of not in terms of such local units as joint, heart, or chorea but as a general disease in terms of infection, constitution, and metabolic and endocrine disorders.

Of particular interest is the paper entitled "Rheumatic Fever as a Manifestation of Hypersensitiveness to Streptococci," by Swift, Derrick, and Hitchcock, based on their experimental work at the hospital of the Rockefeller Institute for Medical Research, New York. They believe that this hypersensitiveness or allergy of certain individuals to streptococci results from repeated low-grade infections or persistence of foci of infection. When the streptococci are disseminated to the tissues, these tissues overreact and the characteristic picture of the disease results.

In regard to treatment it is refreshing to note that these men, although assembled at the famous bath resort, were honest enough to have little to say about the therapeutic properties of these or other baths. The benefit derived, aside from the psychological factor, from any form of physiotherapy in these diseases is very questionable.

It is evident that autogenous vaccines from the nose and throat have a definite and often high value in selected cases. The elimination of such foci as found in teeth, tonsils, prostate, and seminal vesicles is of great importance.

As for drugs, F. John Poynton, of London, believes from his experience that in the acute stage cinchonic acid is much safer than the salicylates, especially in children.

CONSTITUTIONAL INADEQUACIES, by Nicola Pende, M. D., Professor of Clinical Medicine, Royal University of Genoa, Italy. Translated from the Italian by Sante Naccarati, M. D., Sc. D., Ph. D., Associate Professor of Nervous and Mental Diseases, Post Graduate Medical School of New York City. Lea & Febiger, Philadelphia, 1928.

Although this book contains only 250 pages, the matter is so abstruse and the treatment of the subject so exceedingly involved that to read and digest it requires much more time and expenditure of mental energy than would be the case in the ordinary medical volume of thrice the size. Rare indeed is the reader who possesses the sufficient understanding and patience required to develop the enthusiasm shown by George Draper, who has written the foreword to the book and who believes that "the conscientiousness, thoroughness, energy, and perspicacity which Professor Pende, as pupil of his great masters, De Giovanni and Viola, has put into his own efforts in the field of human constitution, are reflected in this monumental work which marks him as an outstanding leader in this domain of medical research."

Four pages of glossary are appended to define the terms used which are new in English medical literature and 14 pages are quite necessarily devoted to the author's definition of constitutional inadequacies and his dissertation on the various concepts of the subject.

In the latter part of the book the reader begins to experience a certain trepidation when he finds that he is being led far afield into the intricate realm of endocrinology, and here, as he discerns much that is pure fustian, he strongly suspects that he is in the hands of a pilot who is all too complacent, being unaware of the dangers of a sea so poorly charted as that of endocrinology. Nevertheless there is a paragraph dealing with the definition which is fairly clear compared to most of the paragraphs and which illustrates rather well what the author is talking about and his manner of saying it. He states here that "the constitution is the morphological, physiological resultant (variable in each individual) of the properties of all the cellular and humoral elements of the body, and of the combination of these in a special cellular state having a balance and functional output of its own, a given capacity for adaptation, and a mode of reaction to its environmental stimuli. Such a resultant is determined primarily by the laws of heredity, and secondarily by the disturbing influences exercised by the environment upon the individual's hereditary plan of organization."

Pende endeavors by means of measurements, tests, and observations of many kinds on a mass of individuals, and the compiling of several tables of figures and facts, to lay down for us a sort of standard of constitutional perfection. He then attempts to draw up an elaborate system by which inadequacies, anomalies and other deviations from this standard in all the organ groups may be recognized and measured. Every anomaly has an accompanying syndrome. For example, a constitutional or physiological albuminuria which results from a constitutional increased permeability of the renal filter to the albumin of the blood is an anomaly not localized in the kidney, but involves the whole organism and may be accompanied by an atonic or asthenic constitution, enteroptosis, vertigo, headache, tachycardia, constipation, oxaluria, epistaxis, hematuria, and a diminished excretion of chlorides, urea, and water.

There are many types of genital anomalies resulting from a variety of inadequacies. Thus, the primary hypogenital type, as evidenced by a disproportionate length of the lower extremities (puberal eunuchoidism) may result from constitutional insufficiency of the hypophysis, thyroid, thymous, adrenals, and pineal. We are either vagotonic or sympatheticotonic and possess a "megalosplanchnic hypervegetative" constitution or one that is "microsplanchnic hypovegetative."

Psychological as well as physical criteria are employed to distinguish these conditions and we find that the vagotonic person is "serene, apathetic, or depressed," while the sympathicotonic one is "intolerant, irascible, aggressive, and hyperactive."

The section on treatment is much more understandable than the rest of the book, for the methods described are well known even to those who have not delved so deeply as the author into the study of constitutional inadequacies.

Here the aim of treatment is to "cure the soil . . . to the end that exogenous disease agents may not succeed in getting a foothold." To illustrate more fully:

"The fact is worthy of reflection that, in this high mission of strengthening and augmenting resistance, of prolonging life and youth, of elevating the organism ever more and more toward the ideal somatic and psychic balance, toward happiness of body and soul, the modern physician pursues a goal which seems the reverse of that followed by Nature with regard to the human and all other species; for Nature is niggardly toward the individual and is little preoccupied about his health except in so far as and as long as this is necessary for his contribution to the preservation of the species (after which, he goes rapidly toward death); but we, on the contrary, put up a struggle for the individual in order to secure for each one the greatest physical and psychic well-being within the limits assigned by the iron laws of heredity, which, as has been said, dominate the individual constitution."

More specifically, certain exercises are used to strengthen certain muscle groups, certain diets are prescribed to spare a pancreas which is constitutionally inadequate or to conserve the kidneys in a case of "hereditary renal weakness." Thyroid extract is used in cases of thyroid deficiency and Lugol's solution is employed in certain other thyroid disorders. Hereditary and congenital anomalies and inadequacies are coped with in the fields of eugenics and prenatal care.

LOW BLOOD PRESSURE, ITS CAUSES AND SIGNIFICANCE, by *J. F. Halls Dally*, M. A., M. D., B. Chir. Cantab., M. R. C. P. London. William Wood & Co., New York, 1928. Price, \$5.

The text consists of 240 pages well printed in heavy type on rough paper, inviting and easily read.

Low blood pressure is discussed with reference to variations in arterial pressure, but special stress is laid on the presence, cause, and effect of low pressure. There are 12 chapters, each covering a definite part of the general subject. The subject is a neglected one in medical literature and the author's views and discussions seem well founded and of great clinical value. The author's opinion is that "the subject of hypopiesis, whether congenital or acquired, is never a

normal person." His "Biological law of low arterial pressure," based on the view just stated, is that "low arterial pressure, whether congenital or acquired, temporary or permanent, is an expression of low vitality." He gives a table of "theoretical standard arterial pressures in males of medium physique at various ages" as a guide. It is stated that "failure in the maintenance of an efficient head of pressure within the circulatory system results in the production of an arterial pressure that is unduly low and may be brought about in one of three ways: (a) Feebleness of contractile power on the part of the ventricles of the heart; (b) by lowered resistance in the systemic periphery; or (c) by feeble heart action in combination with failure of peripheral resistance."

In the absence of organic disease, the author states: "From the manifestations common to the essential low arterial pressure group as a whole, it would appear that this low vitality condition often occurs in association with an inherent diminution of peripheral tonus consequent upon a constitutionally lessened autonomic-endocrine vasomotor control."

In the presence of acute organic disease the author states that "it is more than likely that the same law applies to all infective processes. An acute and active reaction to an acute infection, when successful, at this early stage is invariably accompanied by a rise in arterial pressure of short duration and very liable to be overlooked," while "unsuccessful reaction to an acute infection, as well as the stage of depression during convalescence, are accompanied by a fall in arterial pressure which usually lasts a much longer time than the duration of the rise"; also, "low arterial pressure is usually found as an early and constant symptom of acute toxæmia," diphtheria, pneumonia, and erysipelas being stated as excellent examples.

In tuberculosis it is stated that "the degree of decline of arterial pressure in pulmonary tuberculosis is directly dependent upon the amount of absorption into the system of tuberculous toxins; as toxæmia waxes so arterial pressure wanes."

Diagnosis and prognosis of low pressure is discussed in 21 pages. The level of 110 millimeters of mercury on the sphygmomanometer scale is generally adopted as the upper limit of states of low arterial pressure, any systolic pressure below this level being taken to indicate the presence of hypopiesis. The author holds that the main objectives are "(1) to differentiate the kind of case which is capable of reacting to stimuli from that which is incapable of so doing, and (2) to determine in the latter class the amount of reactive capacity."

Control of low arterial pressure and its treatment by organotherapy and drugs and under certain conditions are elaborated in Chapter XII.

The subject matter is interesting and the book seems timely and a pioneer in the field.

GOITER PREVENTION AND THYROID PROTECTION, by *Israel Bram, M. D., Formerly Instructor in Clinical Medicine, Jefferson Medical College, Philadelphia.* F. A. Davis Co., Philadelphia, 1928. Price, \$3.50.

This little book is written for the lay public and contains nothing new for the physician nor anything that would interest him particularly.

Bram believes there are about 7,000,000 cases of goiter in the United States and thinks the problem should be considered a national question here as in other countries where goiter is so prevalent. In parts of British Columbia, where even the animals are afflicted, the question has become a serious one, as in the Canton of Berne, Switzerland, where 75 per cent of the 6-year-old school children and 94 per cent of the 16-year-old school children have goiter.

There is so much repetition that it would be difficult to escape the few points the author has mentioned.

He believes that such factors as worry, anxiety, grief, and mental shock are the most potent causes of exophthalmic goiter and that their avoidance should be our chief concern in the prevention of this disease.

The thyroid, in his opinion, may be protected and thus goiter prevented by attention to infected teeth and tonsils, by the proper regulation of digestion and sleep, and by the avoidance of worry and fatigue.

Pregnant women deficient in thyroid should receive small amounts of the gland regularly as a matter of prenatal care toward the prevention of the birth of cretinous and feeble-minded children.

While much good has come from the administration of sodium iodide in proper amount to school children, Bram believes that great dangers lie in the indiscriminate use of iodine and thyroid extract, especially in the form of patent medicines used for weight reduction and other purposes.

There is an appendix devoted to endocrinology which will doubtless afford first-class entertainment and interest to the layman.

A TEXTBOOK OF PHARMACOLOGY AND THERAPEUTICS, by *Hugh Allister McGuigan, Ph. D., M. D.* W. B. Saunders Co., Philadelphia, 1928.

In the opinion of the reviewer this is an excellent book and seems especially desirable for the use of medical students. The subject matter is descriptive, clear, and understandable. There is a distinct absence of the "heaviness" to be found in almost all textbooks on

this subject. One may readily find what one desires to know about a medicament, its action, usefulness, and desirability in practice. Chemical formulæ and other diagrams appear frequently together with useful comment upon the condition or disease to be treated and the effect to be expected of the drug. The clinical side of pharmacology and therapeutics seems to be kept constantly in mind and applied in a manner which adds much to the gain of the reader. The book is of medium size, well arranged, clearly printed, and the author's style is agreeable.

RULES FOR RECOVERY FROM PULMONARY TUBERCULOSIS, A LAYMAN'S HANDBOOK OF TREATMENT, by *Lawrason Brown, M. D.* Fifth edition. Lea & Febiger, Philadelphia, 1928. Price, \$1.50.

As in past editions of this useful little book, Doctor Brown has given rules for tuberculous patients to follow which he has found in his own vast experience most helpful.

The patient who reads the book will have a better understanding of what his physician is trying to accomplish and will therefore be more careful to follow the advice given.

If for no other reason, patients suffering from tuberculosis should read what the author has to say in order not to be a menace to their friends and associates who are caring for them.

THE NEW YORK ACADEMY OF MEDICINE LECTURES ON MEDICINE AND SURGERY, by 15 contributors. (First series, 1927.) Paul B. Hoeber (Inc.), New York, 1928. Price, \$5.

This is a publication in book form of "The First Series of Practical Lectures for the General Practitioner, Arranged by the Committee on Medical Education and Given at the New York Academy of Medicine, 1926-27." Each lecture is a monograph, and the subjects presented in both medicine and surgery are varied.

These lectures may be read and reread with interest and profit. The style is free and readable, the wording is almost informal and conversational, so that the subject matter is easily grasped, being of practical character; and as one reads one gains a lucid idea of the subject. The old subject, cardio-vascular syphilis and its treatment, is presented in a most helpful manner.

The treatment of pneumonia is discussed in its latest conception. There are some splendid illustrations of cutaneous manifestations of syphilis showing lesions that are now in these days of salvarsan becoming most rare, if seen at all. And more could be said as to the other subjects discussed.

The reviewer commends the book especially to those who are interested in general medicine.

URINARY ANALYSIS AND DIAGNOSIS, by *Louis Heitzman, M. D., Formerly Professor of Pathology and Bacteriology, Fordham University School of Medicine.* Fifth edition. William Wood & Co., New York, 1928.

This book, containing 366 pages and 139 illustrations, mostly drawings of high-power microscopic views of urinary sediments, has also a chapter on the Determination of the Functional Efficiency of the Kidneys, by Walter T. Dannreuther, M. D., professor of gynecology, New York Post Graduate Medical School.

The book should be found interesting and a valuable reference by the internist, laboratory technician, or the urologist.

One of the impressive features is the particular stress the author lays on the possibility of determining the source of epithelia found in the sediment by high-power microscopic examination. But in attempting to follow his methods and descriptions one feels that only a highly trained histologist could differentiate with any certainty these epithelia, and that the newer methods of the urologist would be preferred whenever the determination of the exact location of the lesion is desired.

One fact which he has well brought out is the comparatively common finding of connective tissue shreds, which were formerly often overlooked through being mistaken for mucous strings or such extraneous substances as linen or cotton fibers. The importance of this fact is in the significance of these shreds in indicating the possible presence of grave or extensive lesions.

In the first part of the book the chapters are classified according to urinary findings, with their significance and a detailed description of methods for their qualitative and quantitative determination. The later chapters are classified according to diseases, with the urinary findings in each of these conditions.

DISEASES OF THE MOUTH, by *Sterling V. Mead, D. D. S., Professor of Oral Surgery and Diseases of the Mouth, Georgetown Dental School; Professor of Diseases of the Mouth, Georgetown Medical School; Oral Surgeon to Georgetown Hospital; Dental Surgeon to Providence Hospital; Oral Surgeon to Gallinger Municipal Hospital; Consulting Dental Surgeon to Washington Sanitarium and Hospital; Consulting Dental and Oral Surgeon to Shady Rest Sanitorium, Washington, D. C.* Third edition. The C. V. Mosby Co., St. Louis, 1928.

The fact that this book, which was first published a year ago, has already reached its third edition shows very well how cordially it has been received by both the medical and dental profession and how much interest there is in this subject at present.

The first edition was reviewed in the *BULLETIN* of January, 1928. In this latest edition many new illustrations have been added and the subject has been brought as nearly as possible up to date.

THE SENSORY AND MOTOR DISORDERS OF THE HEART, THEIR NATURE AND TREATMENT, by *Alexander Blackhall-Morison, M. D., F. R. C. P.* Second edition, William Wood & Co., New York, 1928. Price \$6.

This appears to be a posthumous publication presented by the widow of the author.

In Part I, on the "Disorders of the Heart," the author discusses the development and the anatomy in detail of the musculature and innervation of the organ in a manner which gives the reader a particularly clear picture of the associated structures and functions.

In Part II, on the "Sensory Disorders of the Heart," there is a discussion of the pathology of the heart structure with reference to the coronary circulation, clinical consideration of the conditions associated with pain, and treatment of cardiac pain by the usual means as well as by surgical procedure are dealt with at some length.

In Part III, on "Motor Disorders of the Heart," the author takes up deviations from the average normal of cardiac motion with reference to underlying pathology or causative factors. This part constitutes the major portion of the book and is well handled. Treatment, with the presentation of seven cases operated upon, is fully discussed.

The whole book is most interesting and instructive. From it one gains a comprehensive view of the heart as a functioning organ, together with those factors of faulty innervation, faulty blood supply, calcareous change, irregularity of motion, etc., which bring about alteration of function. It is a good book for the student, and especially the general practitioner. Young men about to specialize on the heart will find it valuable for the groundwork of their speciality.

THE COORDINATION OF REFRACTION WITH SPECTACLE AND EYEGLASS FITTING, by *Sidney L. Olslo, M. D., Instructor in Ophthalmology, Jefferson Medical College, etc.* Pelham Publishing Co., Philadelphia, 1928.

This little book should be of interest and value to all ophthalmologists. Base-line refraction is not new, but it is a known fact that few oculists make proper use of its principles.

The author lays down a hard-and-fast rule for the establishment of the base line, viz, that a straight line extending from the outer canthus of one eye to the outer canthus of the other will fix the base line of the patient's face; that this line will always cross at practically the same level of the two corneas and touch the lower margins of the undilated pupils.

He bases this conclusion upon the fact that the two eyes are always on one level. This statement has been disputed. From this basic principle the optical center of all types of lenses can be properly adjusted and truer refraction accomplished.

While one may not agree with all the statements made by the author, we feel that this book is very worth while and that much better work and results would be obtained if more oculists would follow this system.

PRACTICAL SURGERY OF THE ABDOMEN (in two volumes), by *George H. Julliy, M. D., Chief Surgeon of the French Hospital, San Francisco, Calif.* F. A. Davis, Co., Philadelphia, 1928. Price, \$16.

One more book on surgery of the abdomen. The author tells you how he does his work, and he tells it in great detail and in a way that should prove a guide to any young surgeon who is beginning to walk along the path already taken by the pioneers and now being followed by those who have come to march in their footsteps. These two volumes thoroughly studied and diligently followed should help any beginner in surgery. A study of the pages will serve to recall the pitfalls and difficulties which the surgeon daily meets in the practice of his art. These two volumes are not condensed, and the author's method does not contemplate brevity. Thoroughness and detail seems to have been his aim.

THE AMERICAN TEXT-BOOK OF PROSTHETIC DENTISTRY. (In Contributions of Eminent Authorities.) Edited by *Charles R. Turner, D. D. S., M. D., Professor of Prosthetic Dentistry and Dean of the School of Dentistry, University of Pennsylvania, Philadelphia,* and *L. Pierce Anthony, D. D. S., F. A. C. D., Associate Editor of the Dental Cosmos.* Fifth edition, thoroughly revised. Lea & Febiger, Philadelphia, 1928.

Fifteen years have passed since the last edition of this work was published. During that time attention has been more and more directed toward improvements in prosthetic dental restorations to replace the loss of the natural dental organs, and this volume as a whole is regarded as a distinct addition to the literature of the profession.

The work has been modernized by 13 leaders in prosthesis. It contains 881 engravings and 3 colored plates and maintains a nice balance between the theoretical and practical.

CHIRURGIE DES LAND, SCHIFFS, UND KOLONIALARZTES, by *Professor Dr. Med. W. von Oettingen.* Theodore Steinkopff, Dresden and Leipzig, 1928. Price, 20 reichsmarks.

In less than 400 pages of a rather small paper-bound volume, Doctor von Oettingen has condensed a veritable encyclopedia of surgical practice for "land, ship, and colonial work."

In the true thorough German style the matter is systematized to a high degree and nothing escapes classification and tabulation with all the detail and precision one might expect in an exhaustive botanical key or a system of organic chemical analysis.

It is a handy reference on all branches of surgery and perhaps would be of considerable value to a German-reading pharmacist's mate on independent duty. A young German interne would find it a very frequent and valuable aid, because it tells him exactly what to do on any and every problem that might arise, from the extraction of teeth, through urology, gynecology, and fracture work to plastic surgery.

The author has shown rare genius in the mass of solid detailed information he has been able to include on so great a variety of subjects in such a small book.

STEDMAN'S MEDICAL DICTIONARY, by *T. L. Stedman, A. M., M. D.* Tenth revised edition. William Wood & Co., New York. Price, \$7.50.

In this volume, containing some 1,200 pages, there are many excellent illustrations and valuable reference tables. An effort has been made to keep the weight and bulk of the book within practical limits, and this has been partly accomplished by the omission of many obsolete terms, trade names of discontinued drugs, and the multiplication of synonyms found in some dictionaries.

The bacteriological nomenclature recommended by the Committee of the Society of American Bacteriologists is used, but for the benefit of those who are familiar only with the earlier classifications there is a table giving the new names with cross references from the more familiar terms.

GOULD'S MEDICAL DICTIONARY, by *George M. Gould, A. M., M. D.* Edited by *R. J. E. Scott, A. M., M. D.* Second edition. P. Blakiston's Son & Co., Philadelphia, 1928. Price, \$7.

This second edition leaves nothing to be desired, and in many respects is more of an encyclopedia than a dictionary. It contains 1,500 pages with 83,000 words defined. There are many illustrations, and 170 tables for handy reference.

There is a new table of micro-organisms, comprising 68 pages, by *D. G. Bergey, M. D.*, Professor of Hygiene and Bacteriology, University of Pennsylvania.

INTERNATIONAL CLINICS, VOLUMES I, II, AND III. THIRTY-EIGHTH SERIES. Edited by *Henry W. Cattell, M. D.*, with the collaboration of *Chas. H. Mayo and others.* J. B. Lippincott Co., Philadelphia, 1928.

The usual standard of articles which appear in *International Clinics* is maintained in these three volumes.

A wide range of subjects is covered and, since every article is by an authority in the particular subject with which it deals, everything in the books is worth reading.

Volume II is the one hundred and fiftieth Quarto-Anniversary Number, and in it Sir Humphrey Rolleston and other distinguished

physicians and surgeons take advantage of the occasion to extend felicitations to the publication for what it has accomplished and to its distinguished editor, Doctor Cattell, for the success that has crowned his efforts during his years of editorship.

In addition, this volume contains a series of valuable articles on the medico-dental borderland and other subjects.

Of particular interest in Volume III is the 1928 Harrington lecture by Raymond Pearl, entitled "Alcohol and Life Duration." This article will supply much comfort to those who fit into the class of "moderate drinkers," since Doctor Pearl's statistical studies show that this class may expect even longer life than the total abstainers.

PROGRESSIVE MEDICINE, A Quarterly Digest of Advances, Discoveries, and Improvements in the Medical and Surgical Sciences. Edited by *Hobart Amory Hare, M. D., LL. D.*, assisted by *Leighton F. Appleman, M. D.* Volume IV. December, 1927. Lea & Febiger, Philadelphia, 1927.

The volume covers the diseases of the digestive tract and allied organs, of the kidneys, genito-urinary system, surgery of the extremities, shock, anesthesia, infections, fractures, dislocations, and tumors. The subject matter, presented by five contributors, all of whom are well known to the medical profession, is the usual review and compilation of the literature and investigations upon modern practices and advances.

There is much new and interesting information. There is an instructive résumé on the stomach and its functions, and a discussion of the effect of food, drugs, and other substances and diseases on its several functions and secretions. Gastric and duodenal ulcers are discussed at some length. Blood transfusion is discussed, its dangers pointed out, and a new pump apparatus as suggested by Head is described in detail.

There is instructive comment on the modern treatment of burns, skin grafting, and the operative treatment for the reinforcement of relaxed joints, more especially of the knee and shoulder, by the use of open incision of the joint cavity, overlapping plication of the ligamentous and capsular structures, and reinforcing by strips of fascia laced into the relaxed capsule.

The volume is well worth the reading.

COLLECTED PAPERS OF THE MAYO CLINIC AND THE MAYO FOUNDATION. Edited by *Mrs. M. H. Mellish* and *H. Burton Logie, M. D.* Volume XIX, 1927. W. B. Saunders Co., Philadelphia, 1928.

As there are nearly 200 papers on a great variety of subjects in this large volume, it is impossible to attempt a review of its contents. As in previous volumes, the material has been selected from papers writ-

ten by members of the staffs of the Mayo clinic and the Mayo foundation. These papers are of interest to the general surgeon and the diagnostician. Seventy-eight of the papers are on subjects belonging more to the limited fields of medicine and are either abridged or abstracted, while 220 belonging to the various specialties are simply indexed according to the title and journal reference.

INTERNATIONAL MEDICAL ANNUAL, FORTY-SIXTH YEAR, 1928. William Wood & Co., New York. Price \$6.

To review this Annual would be an impossible task, as it is, itself, a very comprehensive review of the recent literature on practically all medical subjects.

The subjects discussed are arranged in alphabetical order, so are easily found; the references are numerous, showing that the literature has been thoroughly covered; and the contributors, all of whom are British, are men of high standing, so their abstracts are trustworthy.

THE SURGICAL CLINICS OF NORTH AMERICA, OCTOBER, 1928. W. B. Saunders Co., Philadelphia.

This is a New York number and most of the papers are from the Fifth Avenue Hospital of that city.

Among the papers of special interest is one by F. W. Bancroft telling of the advances made in the treatment of acute appendicitis in the past 10 years.

Kingsley Roberts makes a preliminary report of a mixture used in his clinic for skin disinfection. It is called "MBGV-5" and is made up of 5 per cent methylene-blue and 5 per cent gentian-violet in 50 per cent alcohol. Results were most encouraging, but further work must be done before the mixture can be accepted as a complete antiseptic.

Other papers discuss many problems of surgical practice.

MEDICAL CLINICS OF NORTH AMERICA, SEPTEMBER, 1928. W. B. Saunders Co. Philadelphia.

This number of the well-known Medical Clinics is made up of papers from members of the faculty of the College of Medicine of the University of Nebraska. As usual, there is a wide variety of topics, including goiter, hypothyroidism, endocarditis, arthritis, and diabetes.

The Medical Clinics are always worth reading. This number is no exception.

POCKET MEDICAL FORMULARY, by *William Edward Fitch, M. D., late Major, Medical Corps, United States Army; Attending Physician to the Vanderbilt Clinic; etc.* Fifth edition, revised and enlarged. F. A. Davis Co., Philadelphia, 1928. Price, \$3.

This is a formulary of convenient size which has proved its worth by reaching the fifth edition. In addition to containing about 2,000 prescriptions, the book contains brief directions for diets, a table of differential diagnosis, tables of weights and measures, directions for treating asphyxiation, and a physician's interpreter in English, French, German, and Italian.

It is a disappointment to find in the section on drowning no reference to the generally accepted Schäfer's method of resuscitation.

THE DIVISION OF PREVENTIVE MEDICINE

Commander M. A. STUART, Medical Corps, United States Navy, in charge

Notes On Preventive Medicine for Medical Officers, United States Navy

REACTIONS INCIDENTAL TO THE ADMINISTRATION OF 191,778 DOSES OF NEOARSPHENAMINE AND OTHER ARSENICAL COMPOUNDS IN THE UNITED STATES NAVY

By J. R. PHILIPS, Commander, Medical Corps, United States Navy

Since November, 1924, medical officers of the Navy have been required to report monthly the number of doses of arsphenamine, neoarsphenamine, etc., administered. A brief but adequate description of every case in which ill effects were noted is also required.

The first summary and analysis of the figures compiled from these reports was published in the United States NAVAL MEDICAL BULLETIN for September and October, 1925. The number of doses reviewed in that study was 24,745, and 64 severe reactions were described.

The second compilation was published in the January, 1927, number of the BULLETIN. At that time the number of doses administered in the Navy since November, 1924, had increased to 91,707, and the number of severe reactions reported had risen to 121.

The present article includes all doses administered from November 30, 1924, to January 1, 1928, making a total of 191,778. None of the 121 severe reactions reported in the two previous articles will be individually described here. Fifty-seven additional severe reactions, fatal and non-fatal, have been reported to January 1, 1928. Of these, 7 that were fatal and 10 others which were regarded as more or less alarming in character will be discussed in detail with a view to continuity of record.

First, figures will be presented for the entire series of 191,778 doses. They are as follows:

TABLE I

Numbers of mild, severe, and fatal reactions, and numbers of doses of arsenical compounds administered

Drug	Total number of doses administered	Mild reactions	Severe reactions	Fatal reactions	Ratio all reactions to doses administered	Ratio fatal reactions to doses administered
Arsphenamine.....	17,767	15	10	1	1 to 683	1 to 17,769
Neoarsphenamine.....	167,442	110	31	10	1 to 1,109	1 to 16,744
Sulpharsphenamine.....	2,081	0	0	0	-----	-----
Tryparsamid.....	4,488	1	0	0	1 to 4,448	-----
Total.....	191,778	126	41	11	1 to 1,077	1 to 17,434

It will be noted that there is no significant difference in the ratio of fatal reactions to number of doses administered as between arsphenamine and neoarsphenamine, but, of course, the number of recorded arsphenamine doses is still so small that no great emphasis should be laid on this point.

Fatal reactions resulting from the administration of arsphenamine and neoarsphenamine in the Navy during the past nine years.—Statistics are not available for 1918 or any earlier year. Deaths have been charged to the administration of arsenical compounds since 1918 as follows:

TABLE II

Drug	Arsphen-amine	Neoarsphen-amine	Kind not specified	Total
1919.....	2	0	¹ 1	3
1920.....	1	1	0	2
1921.....	3	1	0	4
1922.....	0	4	0	4
1923.....	0	1	0	1
1924.....	1	2	0	3
1925.....	0	2	0	2
1926.....	0	4	0	4
1927.....	1	4	0	5
Total.....	8	19	1	28

¹ No data available.

The cases may be classified as follows:

TABLE III

	Arsphen-amine	Neoarsphen-amine
Acute encephalitis.....	5	13
Immediate shock-like reaction; death in 60 minutes and 90 minutes.....	1	1
Delayed shock; death in 12 hours.....	0	1
Sudden death 45 hours after second dose; thrombosis, right ventricle and pulmonary artery.....	1	0
Acute arsenical poisoning: Death 31 hours after 0.4 gram dose; hemorrhages into stomach and intestines.....	0	1
Acute arsenical poisoning: Transverse myelitis (bulbar); three doses, amounts not stated, given in one week.....	0	1
Acute arsenical poisoning and acute mercurial poisoning: Embolism anterior tibial artery; edema of the lungs.....	0	1
Purpura hemorrhagica: Hemorrhages began a few hours after second dose; death on the fifteenth day.....	1	0
Dermatitis exfoliativa: Death one month after third dose.....	0	1
Total.....	8	19

NOTE.—There was one additional death for which no data was available.

It will be noted that in 18 of 27 fatal cases, as shown in Table III, poisoning was of the acute encephalitis type. The intervals from the intravenous injection of the final dose of the drug to the time of death in these cases were as follows: 43, 43, 54, 55, 60, 64, 70, 72, 78, 80, 80, 80, 84, 87, 92, 92, and 136 hours.

Figures showing the frequency of deaths in relation to numbers of doses administered are available only from December, 1924. The figures for neoarsphenamine are of particular interest, because that is the drug principally used everywhere in the treatment of syphilis at the present time. In December, 1924, 1,659 doses of that compound were administered intravenously with no deaths. Since then the experience by calendar years has been as follows:

TABLE IV

Year	Number of doses of neoarsphenamine administered	Fatal reactions	Ratio
1925.....	41,791	2	1 to 20,895
1926.....	55,652	4	1 to 13,913
1927.....	68,340	4	1 to 17,085

It would be interesting at this time to know how the total number of syphilis cases has varied from year to year. Figures are available only for the calendar years 1925 and 1926 when the numbers were respectively 2,443 and 2,973. The numbers of new recorded cases by years have been as follows:

	Cases	Admission rate per 1,000		Cases	Admission rate per 1,000
1920.....	2,470	17.55	1924.....	2,355	19.74
1921.....	2,656	17.84	1925.....	2,261	19.59
1922.....	2,446	20.03	1926.....	2,505	22.02
1923.....	2,170	18.62			

The admission rate each year—new cases—is influenced by many factors, among which may have been increased attention to the discovery and recording of cases. It is possible that the average number of doses of neoarsphenamine per case has increased. The figures presented above seem to indicate this, but there may also have been more follow-up treatment in old cases.

Accurate information bearing on these various points can only be obtained by keeping record of the numbers of doses administered, for comparison over a period of several years with the results of careful analysis of the annual statistics regarding syphilis in the Navy. For example, in 1925 there were 26 doses of arsenical compounds given per case of syphilis treated, and in 1926 the number was the same. Record is now being kept of complications as well as deaths from syphilis, but the statistics will not have any great value until enough years have passed to justify comparison.

Meanwhile, so far as untoward results of treatment with arsphenamine or neoarsphenamine are concerned, it appears that a fatal reaction is to be expected once in about 17,000 intravenous injections.

Fatal reactions following the intravenous injection of neoarsphenamine.—As shown in Table IV, there have been, altogether, 10 fatal reactions incidental to the intravenous administration of 165,783 doses of neoarsphenamine during the past three years.

Four of the 10 fatal reactions have been individually described in previous articles, leaving 6 to be discussed here. The information available concerning these is as follows:

CASE I. Lot number of neoarsphenamine not determined; manufacturer same as designated by Key letter J. The patient, a seaman, first class, about 21 years of age, who had syphilis in the primary stage, was admitted to the sick list February 3, 1926, on board U. S. S. *West Virginia*. He was given 0.45 gram neoarsphenamine February 5; 0.65 gram, February 9; and 0.9 gram, February 16. February 18, 1926, about 55 hours after the third dose, he was found unconscious ashore and was taken to the U. S. S. *Relief* in a state of coma. Vomiting and involuntary bowel movements were noted. His muscles were in a state of toxic spasm and he also had convulsive movements. His pupils when first seen were widely dilated, but later were contracted. The skin was cold and clammy, but his temperature was normal. The pulse was also described as normal. Blood pressure was recorded as 150 systolic and 90 diastolic. Spinal puncture yielded clear fluid containing a few red cells. Kahn test was negative. His urine contained a trace of albumin, granular casts, and red cells.

The following morning Cheyne-Stokes respiration was observed and he had several convulsions. Pulmonary edema supervened. Death occurred at 4.30 p. m., February 19, 1926, about 78 hours after the fatal dose was injected. The patient was not conscious at any time after he was found.

Autopsy showed acute nephritis, congestion and edema of the brain, and edema of the lungs. Healed tuberculous lesions were also found in the lungs.

The nature of the case was apparently not determined on board the hospital ship. The case was reported as one of acute nephritis, and its true nature did not become apparent until the death report was studied in the division of preventive medicine preliminary to analysis of the vital statistics of the Navy.

CASE II. Lot number neoarsphenamine designated by key letters AK. The patient, a seaman, first class, 27 years of age, had primary syphilis, diagnosed by finding *T. pallidum* in the chancre, October 1, 1926. He was given 0.45 gram neoarsphenamine October 5, 0.6 gram October 13, and 0.9 gram October 20. Between doses he was given three intramuscular injections of a soluble compound of mercury, dosage not stated.

About 40 hours after the last dose of neoarsphenamine the patient complained that his stomach was upset. He had diarrhea. His temperature was normal. The following day, about 60 hours after the dose, he had a convulsion and shortly afterwards was transferred to the U. S. S. *Relief*, where he was unconscious upon admission. He continued to have convulsions at short intervals. Lumbar puncture yielded clear cerebrospinal fluid under normal pressure. Sodium thiosulphate was apparently not exhibited. He grew worse and became cyanotic. Respirations were rapid and shallow; the pulse was rapid, weak, and thready. He died about 92 hours after his third dose of neoarsphenamine.

Post-mortem examination revealed hemorrhagic encephalitis, with marked edema of the cerebral cortex. The liver was congested and there were numerous small hemorrhages throughout. The spleen was congested, friable, and hemorrhagic. The kidneys showed cloudy swelling with small hemorrhages.

CASE III. Lot number of neoarsphenamine designated by key letters AK. The patient, a coxswain, age 26, serving on board the U. S. S. *Altair*, had a venereal sore in August, 1927, following exposure in Balboa, Canal Zone. November 28, 1927, he was found to have a 2-plus Kahn test. The following day he was given 0.45 gram neoarsphenamine. December 6, 1927, he was given 0.6 gram intravenously as his second dose. About 42 hours later he felt dizzy. Shortly afterwards he began to have muscular twitchings and complained of pain in his back and hips. At that time his temperature was 101.2° F.; pulse, 130; and respirations, 30.

He was transferred about four hours later to the United States naval hospital, San Diego, Calif. Upon admission to hospital he was staring wildly but did not appear to take notice of anyone and did not respond to questions. One gram of sodium thiosulphate was given intravenously at once.

He had a convulsion about two hours after admission. Lumbar puncture was performed. The cerebrospinal fluid was slightly murky and under increased pressure. Fluid to the amount of 50 cubic centimeters was withdrawn and 25 cubic centimeters of antimeningococcic serum was introduced. There was slight retraction of the head. At 4 p. m., after an interval of two hours, or four hours after the first dose of sodium thiosulphate, another gram was given intravenously. At 6 p. m. he had another convulsion and Cheyne-Stokes breathing was observed. He died at 7.20 p. m., about 55 hours after the fatal dose of neoarsphenamine.

At autopsy the brain was found edematous and there were extravasations of blood in both internal capsules. Edema of the lungs, liver, and kidneys was also recorded.

CASE IV. Lot number of neoarsphenamine designated by key letters AK. The patient, a signalman, second class, 25 years old, had a chancre September 20, 1927. He was admitted to the United States naval hospital, San Diego, Calif., with syphilis November 5, 1927. At that time he had a secondary eruption, general glandular enlargement, and mucous patches. He was regarded as having nephritis in mild form but it was deemed safe to treat him with small doses of neoarsphenamine. He had acute nephritis in January, 1926. He was given 0.45 gram neoarsphenamine November 7, 1927; 0.3 gram, November 10; and 0.4 gram, November 14. No reaction followed the first or second dose, but two and one-half hours after the third injection his face was flushed and a scarlatiniform eruption appeared on the body. He complained of sore throat. His temperature was 99.6° F.

An hour later 1 gram of sodium thiosulphate was given intravenously. Another gram was injected about three hours later, and a third similar dose about six hours after the second. His temperature was then 103° F. and his pulse rate was 130. His throat was somewhat inflamed. He vomited a small amount of blood several times during the night; the total amount, perhaps, an ounce and a half. He passed about 3 ounces of blood by rectum also. At 9 a. m., 12 hours after the third dose of sodium thiosulphate and 24 hours after the third dose of neoarsphenamine, 1 gram of sodium thiosulphate was given intravenously. Three hours later the fifth dose of sodium thiosulphate, likewise consisting of 1 gram, was given. His condition was worse and he was breathing rapidly. One-quarter of a grain of morphin and one one-hundredth of a grain of digitalin were given for restlessness without effect. About three hours later

he was failing and 600 cubic centimeters of normal salt solution containing 10 per cent of glucose was given intravenously. The patient died two hours later, or about 31 hours after the fatal dose of neoarsphenamine. He was not delirious and had no convulsion at any time.

Post-mortem examination showed the brain to be normal. The lungs were congested. The liver was somewhat pale. The stomach and intestines showed many petechial spots. There was no free blood in the gastro-intestinal tract. The kidneys were pale and showed evidence of chronic nephritis. Death apparently resulted from acute poisoning by arsenic.

CASE V. Lot number of neoarsphenamine designated by key letter Q. The patient, an officer's cook, second class, 28 years old, was admitted to the sick list on board U. S. S. *Richmond* with syphilis July 27, 1927. He had a chancreoid following exposure in Shanghai, China, in May, 1927, from which smears were negative for *T. pallidum*. The diagnosis of syphilis was apparently based largely upon a 2-plus Kahn test. He was given 0.3 gram of neoarsphenamine July 28, 1927, and 0.9 gram August 4. About two and one-half hours after the second dose he complained of headache and fever. He was very restless, and his temperature by axilla was 106° F. The pulse rate was 114; respirations, 24. Slight twitching of muscles was observed.

One gram of sodium thiosulphate was given intravenously. The dose was repeated 6 hours later and again 3 hours after the second dose. The patient had quieted down, but was still somewhat restless.

The following morning at 8 o'clock his temperature was 104° F., pulse 120, and respirations 26.

Later in the forenoon he was transferred to the Shanghai General Hospital, where cardiac stimulants were given. Treatment with sodium thiosulphate was not continued. His condition was about the same that evening.

The next morning he had a convulsion and died shortly afterwards. Death occurred about 43 hours after the fatal dose of neoarsphenamine. Post-mortem examination apparently was not made.

CASE VI. Lot number of neoarsphenamine designated by key letters AK. The patient, a seaman, first class, 22 years of age, serving on board U. S. S. *Beaver*, had a chancre in July, 1927, and indefinite secondary signs about the first of August. He was given 0.6 gram neoarsphenamine August 4, 0.9 gram August 9, and 0.9 gram August 16. Daily inunctions of mercurial ointment were given in conjunction with the neoarsphenamine.

Three days after the third dose of neoarsphenamine the patient presented a generalized erythematous rash, which progressed to a general dermatitis exfoliativa, with thickening, crusting, fissuring, and exfoliation in the course of about 10 days. There was no jaundice or symptom referable to the liver, and the urine was normal to the end.

Some sodium thiosulphate was given intravenously, 1 gram daily, according to the report, but the number of doses was not stated, and it is not clear when treatment with that salt was begun. Two letters of inquiry remain unanswered.

The patient died September 15, 1927, 30 days after his third dose of neoarsphenamine. Autopsy was not performed. During the last few days of illness the heart action became weak and irregular.

Fatal reaction following the intravenous injection of arsphenamine.—The lot number of arsphenamine used in this case is designated by the key letter S.

The patient, a machinist's mate, first class, 40 years of age, was under treatment at the United States Naval Hospital, Portsmouth, N. H., to which he was admitted as with a psychosis.

At the hospital he was found to have definite signs of paresis. His health record showed that he had had a 1-plus Wassermann reaction in 1914. At that time, it appears, he took some antisyphilitic treatment, the amount and nature of which was not recorded. So far as his health record shows he had no more treatment until March 23, 1927, when he was found to have a 4-plus Kahn test. He had a negative Noguchi test in December, 1921. He was admitted to the sick list August 21, 1926, with the diagnosis, psychoneurosis, hysteria, and was later discharged as fit for duty.

In hospital he was given 0.3 gram of arsphenamine intravenously March 23, and 0.6 grain March 30, 1927. He had no reaction after the first dose, but several hours after the second injection his temperature rose to 103° F. The following day his temperature was 99.5° F. in the morning and 103° F. in the evening. He presented a discrete erythematous rash on the chest and abdomen. The next day the rash was more pronounced, and the patient felt weak in the legs, vomited, and altogether he presented a picture of mild shock. He was clear mentally and had no pain.

He was given 1 cubic centimeter of adrenalin chlorid subcutaneously, and that was followed by 1 gram of sodium thiosulphate intravenously. That evening dyspnea supervened and increased rapidly. The pulse became rapid and almost imperceptible. Death occurred at 10.15 p. m., about 60 hours after the second dose of arsphenamine. He had no convulsion.

Post-mortem examination disclosed intense congestion of the cerebral meninges with serofibrinous exudate. The abdominal viscera and organs appeared normal.

We have classed this case as arsenical encephalitis, but the brain findings may have been due in part at least to syphilis.

Nonfatal neoarsphenamine reactions.—For the purpose of recording from year to year the Navy's experience with neoarsphenamine and other arsenical compounds, we describe reactions which are unusual or severe enough to deserve separate mention, as (a) *severe*, and (b) *alarming*. In all cases the reactions are classified in the Bureau of Medicine and Surgery. Medical officers are required to report the symptoms and signs as observed and the circumstances under which treatment was given. Their opinions are also taken into consideration.

The first question that arises is that of the completeness of reporting. The bureau must rely upon medical officers to follow existing definite instructions to report and describe all reactions which from their nature would be classed as severe or alarming. Many medical officers are following the instructions to the letter, and, properly enough, they even report mild reactions which would appear to have little or no significance. On the other hand, there is reason to believe that some severe, and even alarming, reactions are not reported. In a few instances it has come to the bureau's attention that severe reactions have occurred in naval hospitals for which

reports have not been submitted. In general, it is probable that reporting is more complete by ship and stations than by naval hospitals. Patients under treatment in hospital are already on the sick list under the diagnosis, syphilis, and in case of a severe reaction the diagnosis may not be changed. On board ship, if the man is incapacitated by the drug, he must be admitted to the sick list, and the Form F card is likely to furnish a clue to the case even if the medical officer has failed to mention the reaction in his monthly report. Form F cards are closely watched in the bureau for such cases. From the nature of things there can not be so certain a method of checking the completeness with which nonfatal reactions are reported as in the case of deaths. Every death certificate reaching the Bureau of Medicine and Surgery is carefully studied, and when there is any doubt as to the primary and secondary causes of death the man's entire health record is reviewed; so it is not likely that any fatality which was directly or indirectly due to treatment for syphilis will be overlooked.

Nonfatal reactions as reported are of many kinds, and they vary greatly in degree. In many cases the patients appear not to have reacted in a manner essentially different from what was to be expected, but the symptoms were merely somewhat more pronounced than those experienced by the general run of patients. Some of the reactions reported were probably in the nature of Herxheimer reactions, assuming that such manifestations result from the sudden destruction of large numbers of treponema. In compiling statistics it is not infrequently impossible to decide whether a given reaction was of that nature or was due to poisoning by the drug.

One of the principal reasons for beginning the accumulation of data was to secure evidence as soon as possible regarding such lots of neoarsphenamine as appeared to be unusually toxic. The study was, of course, extended to include arsphenamine and other arsenical compounds. It was soon found that there were certain features about some of the very mild reactions, caused by a given lot number of drug, which suggested that no dividing line could be drawn between very mild and very severe reactions. Certain lot numbers were found to be unduly toxic and were withdrawn from use in the Navy, and, in general, there is little doubt that different lot numbers vary a good deal in potency. The question is also complicated by the probability that different individuals vary greatly in their susceptibility to the toxic action of arsenical compounds. Some of the cases reported as severe reactions have suggested that the symptoms were not due to unusual toxicity of the drug but rather to the fact that the particular patient's tolerance was exceeded. In most cases of this kind the so-called severe reaction, which was usually attributed to the last dose,

would appear to have been due to the cumulative action of several doses given at short intervals.

The study of all reactions, including the very mild ones, as reported by different medical officers following injections of the same lot number, may be expected to give valuable information as to the character of that lot number. Aside from the difficulty of classifying reactions in a practical manner, a statistical compilation of severe reactions caused by numerous lot numbers used in the Navy in a given period of time can not be expected to have so much value. The ratio of fatal to nonfatal reactions reported will doubtless vary greatly from year to year. In one year there may be several deaths with comparatively few nonfatal severe reactions and in another year there may be only one death with a larger number of nonfatal reactions reported.

It is desirable for the purpose of future study to describe each severe reaction which may be classed as severe or alarming. It is true that some of the reactions which individually appeared too mild or trivial in character to be so classed might have had some significance with reference to a particular lot of drug if the truth could be known. Every reaction has been included which at any time, even for a few minutes, appeared to be serious or alarming in character.

The value of this study, of course, depends upon the thoroughness with which medical officers at large in the service report their cases and the accuracy of those reports. In some instances more complete and better reports could have been submitted, but, on the whole, one who studies the case reports which have been printed since this study was begun in December, 1924, can not fail to appreciate the dangers connected with the therapeutic use of arsenical compounds, and he should have a better understanding of toxicological as well as the therapeutic action of these drugs.

Twenty-three severe, including alarming, reactions incidental to intravenous medication with neoarsphenamine, have been discussed in the two preceding articles. Nine reactions, which we have classed as severe (alarming), have been reported to the bureau since the last article was written. These are as follows:

CASES I, II, and III. Lot number of neoarsphenamine designated by key letters AG. Place, U. S. S. *Richmond*.

The patient in CASE I received a first dose of 0.3 gram August 24, 1927. Five and a half hours afterwards he complained of severe headache and had fever, 101° F. Two hours later his temperature was 105.4° F. Half a gram of sodium thiosulphate was then administered intravenously and in a little while his temperature declined to 102° F. The next morning the patient felt well and had no further symptoms.

The patient in CASE II also received a first dose of 0.3 gram August 24, 1927. Six hours after the injection his temperature was 104° F. and by evening he

had an erythematous rash over the body. The next morning he complained of soreness in his legs. He recovered and had no symptoms the second day after his injection.

The patient in CASE III likewise received his first dose, 0.3 gram, the same day on board the *Richmond*. A slight reaction was noted. The symptoms were pain in the chest and weakness. During the following week he was given four innunctions with mercurial ointment. August 31, 1927, he was given a second dose of neoarsphenamine, 0.3 gram. He had a severe reaction after that dose. He was kept in bed for 7 hours after the injection and was allowed to leave the sick bay at 6 p. m. At 1 a. m. he reported ill and complained of extreme weakness, difficulty in breathing, and pain in his chest. His temperature, taken by axilla, was found to be 104.2° F. His pulse rate was 124; respirations, 30. One gram of sodium thiosulphate was administered intravenously at once. Some improvement was noted at 8 a. m. the next morning, but he still complained of pain in his chest. His temperature was then 100° F. and the pulse 72. The respiration count was 24. Another gram of sodium thiosulphate was injected. Gradual improvement took place and his temperature was normal the fourth day after the dose of neoarsphenamine was administered.

The medical officer of the *Richmond* was unknowingly using a lot number of the drug which should already have been withdrawn from use. Through close cooperation with the United States Hygienic Laboratory it came to the attention of the division of preventive medicine, Bureau of Medicine and Surgery, that various lot numbers up to a certain number, including the lot in question here, produced by a certain manufacturer, were not regarded as satisfactory, and it was said the manufacturer had already recalled all lot numbers to a serial number higher than any which had been purchased by the Navy. Neither the Bureau of Medicine and Surgery nor the United States naval medical supply depot had received any information about the matter up to that time. While the recalled lot numbers were in use in the Navy, the three severe reactions discussed above occurred. Another of the condemned lots was associated with two severe reactions at the United States naval hospital, San Diego, Calif., and on board the U. S. S. *Concord*, respectively. A fatal reaction followed a dose of still another of the condemned lots. This is described as CASE V of the series of fatal reactions in a previous paragraph.

CASE IV (nonfatal reaction). Lot number of neoarsphenamine designated by key letters AK. The patient, a private marine, having syphilis in an early secondary stage with a four plus Kahn reaction, was given 0.45 gram neoarsphenamine intravenously January 15, 1927, with no apparent reaction. Three days later he was given 0.6 gram. Four days after that injection the patient complained of general malaise and he presented a hemorrhagic rash over his body. Edema of the eyelids and feet was noted. His temperature was 102° F. The urine contained arsenic. Half a gram of sodium thiosulphate was administered intravenously January 23, and 1 gram was given daily thereafter for five days. By January 31 the patient's temperature was normal and the rash had cleared. No further symptoms developed, and 3 grains of bismudol was

injected intramuscularly February 15, 1927, without untoward results. One-third grain of mercury bichlorid was administered February 25 and March 4. March 8 he was given 0.45 gram of neoarsphenamine intravenously and again had a pronounced reaction. Two days after the injection a rash appeared on his forearms and chest, and his hands and eyelids were slightly edematous but he had no fever. As soon as symptoms were noticed he was given 0.5 gram of sodium thiosulphate and 1 gram the next day. The symptoms disappeared promptly, but he was considered to have little tolerance for arsenic and his treatment was continued with bismudol.

Possibly the medical officer's opinion that this patient had less tolerance for arsenic than most men was correct. At any rate, it is fortunate that he was given small doses. The history of the lot of neoarsphenamine in question, as used in the Navy, is: Four deaths and eight severe reactions, three of which were alarming in character, reported by two naval hospitals, the Marine Expeditionary Force in China, and five different ships. We do not know how much of that lot number was used in the Navy, but probably a great deal. Repeated tests failed to reveal ampules that were unusually toxic for rats.

CASE V. Lot number of neoarsphenamine designated by key letters AE. This is the first case in the Navy to go on to recovery after convulsions and other definite symptoms of acute hemorrhagic encephalitis attributable to arsenical poisoning. The case was reported in detail in the **UNITED STATES NAVAL MEDICAL BULLETIN** for January, 1928, by Lieut. P. F. Dickens, Medical Corps, United States Navy.

The patient, a prisoner, 22 years of age, at Marine Barracks, Parris Island, S. C., presented symptoms and signs of secondary syphilis about the middle of May, 1927. It appears that treatment for syphilis was begun May 18 with one-sixth grain of mercury protiodid three times daily. The number of pills per day was increased by one daily until May 29 when 12 pills were taken. Mercury was then discontinued on account of salivation. June 3, treatment with the protiodid was resumed with the administration of one grain daily. June 7, he was given 0.9 gram neoarsphenamine intravenously without apparent reaction. June 14, he received his second dose of neoarsphenamine; also 0.9 gram. Sixty-six hours later, June 17, 1927, at 8 o'clock in the morning he was found unconscious in the prison grounds and was carried at once to the naval hospital. Upon admission, a few minutes later, he was deeply comatose and very cyanotic. Convulsions occurred at intervals of about three minutes. These lasted one or two minutes and affected the muscles of the neck, face, upper extremities, and muscles of respiration. At the height of each convulsion after a series of clonic movements, the muscles became fixed in tonic contractions. This state would be followed by clonic contractions for a few seconds and then there would be an interval when the affected muscles were apparently at rest. During the intervals, however, a meningeal type of respiration was observed—the so-called Biot's type. The muscles of the leg were flaccid and appeared to be paralyzed. Both pupils were contracted to pinhead size. Neither direct nor consensual reflections were abolished. The pulse was full, bounding, and regular. The systolic blood pressure was 170 and the diastolic, 85. The cerebrospinal fluid was found to be under increased pressure—42 millimeters of mercury. The fluid was clear, contained 150 milli-

grams of sugar per 100 cubic centimeters, and a gave a cell count of 135 per cubic millimeter. A Kahn test with the fluid was negative. Urine withdrawn by catheter was found to contain a large trace of albumin and numerous granular casts with red and white blood cells. A specimen of blood showed 245 milligrams of sugar per 100 cubic centimeters of blood.

Etherization was necessary to control convulsions and 300 cubic centimeters of blood was withdrawn from a vein. The patient was kept under ether about an hour. As soon as the administration of ether was discontinued, convulsions began again and about 10 minutes later respiration ceased. Manual artificial respiration was performed for about 30 minutes, when respiration of the Cheyne-Stokes type began.

Meanwhile, preparations were being made to inject sodium thiosulphate intravenously. Ampules of the chemically pure salt could not be found and a quantity of sodium hyposulphite was taken from the hospital's photographic supplies, washed, and recrystallized. This was ready about three hours after the patient was admitted and the first dose, consisting of 2.5 grams, was given by intravenous injection at that time. Ampules of the pure salt were found soon after the first dose, but, inasmuch as no apparent harm was done, the recrystallized "hypo" was used for all subsequent doses. Seven and a half hours after the first dose, 1.5 grams were administered intravenously, and four hours later 1.5 grams were injected.

About five hours after the first dose, the swallowing reflex returned. Convulsions had ceased but there were still indications of considerable cerebral irritation. The patient remained cyanotic and respiration showed no improvement. Projectile vomiting occurred at that time but was not repeated. With a view to reducing the hydrogen-ion concentration of the tissues, sodium bicarbonate was given by mouth shortly after the swallowing reflex returned—2 cubic centimeters of a 10 per cent solution every five minutes for twelve hours. During that period a 10 per cent solution of sodium bicarbonate was also given by proctoclysis.

No further improvement was noted until about an hour after the third dose of sodium thiosulphate was given. Copious perspiration, involuntary evacuation of feces, and incontinence of urine were then noted, and about the same time respirations approached normal.

Twenty-four hours after the patient was admitted to hospital he was still in a state of coma, but about that time his temperature rose to 101.8° F., and the pulse rate was between 120 and 130. Respirations were 24 to 32.

The fourth dose of "hypo," 0.5 gram, was injected 14 hours after the third, or 32 hours after admission to hospital. Forty-one hours after admission the patient showed the first sign of returning consciousness by asking, "Where am I?" The fifth dose of sodium thiosulphate, 1.5 grams, was administered intravenously 48 hours after admission.

At that time the pupils were equal and reacted to light and accommodation. The patient complained of severe headache and was not entirely oriented. He looked staringly at objects, turned his head from side to side, and had fine tremors of the facial muscles.

Seventy-two hours after admission he was oriented and his headache had disappeared. His urine had cleared up to a certain extent but still contained a trace of albumin and a few casts.

The intravenous administration of sodium thiosulphate was continued. The sixth dose, consisting of 1.5 grams, was given 72 hours after admission, and the seventh and last dose was injected 96 hours after admission. That dose was given more as a matter of precaution than for any other reason, as the patient

was free from all symptoms of arsenical poisoning at that time. He was fully conscious and comfortable but wished to be left alone. The urine was normal and blood chemistry findings were also normal.

The patient recovered without any further noteworthy happening. During convalescence he recalled having received both doses of neoarsphenamine in the prison. He remembered that the second dose was received at 10.30 a. m. Tuesday, June 14, 1927. He remembered resting in bed all afternoon and said he felt no ill effect of the dose that day. He worked all day Wednesday and had a severe headache when he went to bed. He remembered nothing that happened after he went to sleep Wednesday night. According to his cell mate he worked all day Thursday, but complained of feeling ill several times during the day. His cell mate said he got up as usual Friday morning, dressed, answered roll call, and then disappeared. His disappearance led to a search, and he was found unconscious lying on the grass near his cell block. It was raining heavily at the time and he was wet through and through. After his recovery he was discharged from the naval service. He reported his condition by letter written September 15, 1927, in which he stated he was doing well but frequently had headache at night.

CASE VI. Lot number of neoarsphenamine designated by key letters AK. The report in this case was incomplete, and a letter requesting additional information failed to secure the desired report. The previous history of the patient is unknown, and likewise the stage of his disease, diagnostic criteria, etc. He is known to have received 0.45 gram of neoarsphenamine intravenously June 21, 1927, and thereafter he was given 0.9 gram once a week for three doses. Six hours after the last injection his temperature was 104° F. and his pulse 120. He showed signs of collapse. Sodium thiosulphate (doses not stated) was administered intravenously and the dose was repeated two hours later. A pint of normal salt solution was also injected subcutaneously. Recovery was slow, and the patient was not regarded as fit for duty until the seventeenth day after the provocative dose of neoarsphenamine.

CASE VII. Lot number of neoarsphenamine designated by key letters AK. The patient in this case was admitted to the sick list on board the U. S. S. *Helena* with syphilis July 3, 1927, presumably contracted about a month before, but this was not definitely stated. August 2, 1927, he was given 0.45 gram neoarsphenamine without apparent reaction. Two days later he was given 1 grain of mercury salicylate by intramuscular injection. August 9, 0.6 gram of neoarsphenamine was administered, and August 11, 1 grain of mercury salicylate. Treatment was then discontinued because of a severe cold. August 27 he was given his third dose of neoarsphenamine, 0.6 gram. The drug was injected at 9.30 a. m. About 1 p. m. the patient began to feel weak and to have pains in his arms and legs. Three hours later he was found too weak to rise and call for help. Upon being brought to the sick bay he complained of intense pain in the larger joints, especially the wrists. He also complained of numbness and tingling in his fingers and toes. His temperature was 104° F. and the pulse rate was 110. There was no headache, and he was not nauseated. There was marked tenderness in the large joints upon pressure and movement. The urine contained no albumin. One dose of sodium thiosulphate, 1 gram, was given intravenously. His symptoms subsided and his temperature reached normal on the third day. He was discharged to duty the fifth day.

CASE VIII. Lot number of neoarsphenamine designated by key letter P. The patient in this case, a fireman, first class, serving on board U. S. S. *Chaumont*, was infected in a Chinese port early in April, 1927. April 27, *Treponema*

pallidum was found in the initial lesion. He was given 0.45 gram neoarsphenamine April 16; 0.45 gram, April 20; 0.6 gram, April 23; 0.9 gram, April 27; and 0.9 gram, May 4. The day after the last dose the patient noticed itching of the palms of the hands and soles of the feet, but that symptom lasted only a few hours. May 11, he was given 0.3 gram of neoarsphenamine. The dose was reduced because of the paresthesia following the fifth dose. Two days after the small sixth dose there was itching of the hands and feet accompanied by numbness and tingling. The next day dermatitis began. The entire body was affected. The urine was normal.

May 14, 0.5 gram of sodium thiosulphate was administered intravenously. May 15, 0.75 gram was given, and 0.9 gram was injected daily May 16, 17, 18, and 19. Exfoliative dermatitis developed, accompanied by edema which was especially marked over the face and neck. There was much thin exudate, fissuring, and eruption of scattered pustules. The patient's temperature rose gradually from 99 to 101.6° F. The pulse rate averaged 90. The urine contained a slight trace of albumin. Broncho-pneumonia supervened. May 25, 2 grams of sodium thiosulphate were given by mouth and 0.9 gram was given intravenously May 26 and again May 27. The patient recovered from broncho-pneumonia, and eventually his skin cleared up after he had had a series of furuncles and abscesses, but June 14 he was found to have diabetes with more than 4 per cent of sugar in the urine and marked acidosis.

CASE IX. Lot number of neoarsphenamine designated by key letter P. The patient in this case, a boatswain's mate, first class, attached to U. S. S. *Chaumont*, received the dose which caused a severe reaction the same day the patient in the previous case received a 0.9 gram dose, and the lot number was the same. He had syphilis in the primary stage and was given 0.45 gram neoarsphenamine intravenously April 29, 1927, and 0.9 gram May 4. About six hours after the injection on the latter day he had a chill and severe headache. The following day his temperature was 102° F., and during the second night a generalized macular rash developed. There was also edema of the face. The third day the patient's temperature was 104° F., his headache was worse, the conjunctivae were injected, and he was restless.

He was given 0.5 gram sodium thiosulphate intravenously in the forenoon and 1 gram toward evening. The fourth day his temperature was 103° F. He was given 0.75 gram sodium thiosulphate and he vomited immediately after the injection. His temperature was 101.5° F. the morning of the fifth day. The skin eruption began to fade and the facial edema subsided. He was given 0.75 gram sodium thiosulphate daily for three more days. He recovered and was discharged to duty 27 days after the provocative dose of neoarsphenamine was injected.

Nonfatal arsphenamine reactions.—Ten alarming reactions have been reported for arsphenamine since December 1, 1924, incidental to the administration of 17,767 doses. In 1927 one fatal and one non-fatal but alarming reaction occurred. The following is a summary of the latter:

CASE I. Lot number of arsphenamine designated by key letter Z. The duration of syphilis in this case was not determined. While the patient, a seaman, first class, was under treatment for catarrhal conjunctivitis, a Kahn test was performed and reported as four plus. The diagnosis was changed to syphilis and treatment with arsphenamine was begun. Doses were administered intravenously as follows:

Feb. 1, 1927.....	gram..	0.8
Feb. 8, 1927.....	do....	.4
Feb. 15, 1927.....	do....	.5
Feb. 17, 1927, mercury succinimid.....	grain..	.4
Feb. 23, 1927.....	gram..	.6
Feb. 25, 1927, mercury succinimid.....	grain..	.4

After the mercury was injected February 25 the patient stated he had had diarrhea and nausea since the previous day which was attributed by him to some liver he had eaten. No other of many men who partook of the liver was affected. Several hours after receiving the mercury the patient had a chill and vomited yellow material. Vomiting continued, and later the vomitus contained blood. Diarrhea, with green mucoid stools, also continued. Headache was a symptom. The patient's temperature was 102° F. There was tenderness in the epigastrium. The skin was dry and hot. The urine contained blood, but that was thought to be due to the passage of a urethral sound the day before. The next day the urine contained considerable albumin, finely granular casts, and many red cells.

February 26, 0.5 gram sodium thiosulphate was given intravenously; 1 gram was injected February 27 and 0.7 gram February 28. On this day blood chemistry findings were: Nonprotein nitrogen, 41 milligrams per 100 cubic centimeters; urea, 27 milligrams; creatinine, 1.5 milligrams; sugar, 83 milligrams; and chlorides, 450. The patient's temperature was 100° F. that day and the pulse was regular, 110, and of good quality. Vomiting and diarrhea continued. Vomiting stopped March 1 and other symptoms gradually subsided. The urine still contained blood March 3.

SULPHARSPHENAMINE

Returns indicate that 2,081 doses of sulpharsphenamine have been given since monthly reports of treatments with arsenical compounds have been collected. No severe reactions have been reported. Unfortunately, sulpharsphenamine was not in mind when this study was undertaken, and instructions to medical officers did not require a definite statement as to the manner in which the drug was employed. Consequently the numbers of the 2,081 doses given intravenously, intramuscularly, and subcutaneously are not known.

TRYPARSAMID

Returns indicate that 4,488 doses of this compound have been given in the Navy in the treatment of syphilis. One mild reaction has been reported. This occurred in 1927. The case is as follows:

Lot number of tryparsamid designated by key letter O. The patient, a chief machinist's mate, was admitted to the United States naval hospital, Mare Island, Calif., where the diagnosis of cerebrospinal syphilis was established February 25, 1927.

Previously the patient had received intravenous doses of neoarsphenamine as follows:

	Gram		Gram
Dec. 22, 1926.....	0.9	Feb. 1, 1927.....	0.45
Jan. 3, 1927.....	.9	Feb. 4, 1927.....	.6
Jan. 11, 1927.....	.9	Feb. 8, 1927.....	.6

Inunctions of mercury were also given daily during the above periods.

March 1, 1927, 3 grams of tryparsamid were injected intravenously, and that dose was repeated March 8, 1927. Two days after the last injection a rash appeared on the body, followed by general edema of the skin with cracking and oozing. The eyelids and feet were also edematous. The patient's temperature was 101° F. The urine contained no albumin and was negative for arsenic by the Marsh test.

In a few days the rash terminated by desquamation with symptomatic treatment.

AGE, KEEPING QUALITIES OF ARSPHENAMINE AND NEOARSPHENAMINE, TECHNIQUE, ETC.

Nearsphenamine.—The experience of another year but strengthens the belief that some lot numbers of nearsphenamine are more toxic than others, although toxicity tests with rats may not have shown that. Moreover, the question of deterioration has not yet been thoroughly worked out for nearsphenamine. It is known, however, that nearsphenamines are liable to deteriorate with age. One would suppose that deterioration would take place more rapidly when ampules are kept for a long time in a warm place. Experimental evidence as to the effect of light is lacking. But one can make no mistake by keeping the drug cold and dark. There is reason to believe that some makes of nearsphenamine are more apt to deteriorate than others, and there also seem to be variations respecting keeping qualities of different lot numbers of the same make. This is recognized at the United States Hygienic Laboratory, and the question of putting a time limit or expiration date on each lot was carefully considered long ago. Such action has not been taken because deterioration must be regarded as a more or less accidental occurrence, in that at least 90 per cent of all samples of nearsphenamine under ordinary storage conditions remain stable for at least two years, during which time it is reasonable to suppose that the material sold will be used. When nearsphenamine does deteriorate it is apt to do so within a few months. Early expiration dating that would take care of this contingency would practically prohibit the use of the drug.

Everything considered, it would appear preferable not to administer nearsphenamine that is more than two years old. During the past year the United States naval medical supply depot, Brooklyn, N. Y., has arranged to purchase only recently released lot numbers in order that the supply depots at Mare Island, Calif., and Canacao, P. I., may be provided with fresh stock that is not over six or eight months old.

The Navy's experience with deteriorated nearsphenamine has been that carton after carton of recalled lot numbers has failed to show any evidence of deterioration, while other cartons of the same lot number have contained one or more ampules, the contents of which

were hypertoxic for rats or had changed in color or failed to go into solution quickly and properly. The records of the Bureau of Medicine and Surgery show that such spotted deterioration has been found more often in cartons sent in by naval stations in warm climates and by ships which have been cruising in tropical waters. Letters accompanying neoarsphenamine which has been recalled have stated that storage conditions had been bad in that the drug had been kept in a hot storeroom.

Doubtless, in some instances medical officers have not given enough thought to the danger of deterioration or to the preparation of solutions for administration, or to the information which has been published in the UNITED STATES NAVAL MEDICAL BULLETIN regarding arsenical compounds employed in the treatment of syphilis. For example, one medical officer reported a severe reaction from a certain lot number nearly a year after it had been recalled by circular letter.

Another point is that although recalled cartons showing signs of deterioration came, for the most part, from ships and stations where exposure to heat in hot storerooms had occurred, it is also true that lot numbers showing spotted deterioration under such circumstances were more than two years old and some were five years old.

The only way the medical officer can safeguard his patients is by the careful inspection of each and every ampule used immediately before the drug is administered. It should be remembered that only an occasional ampule may show physical evidence of deterioration. First, the medical officer should know that the drug is not more than two years old. Inspection should take into consideration color change and appearance of the dry powder. The powder should dissolve completely without delay, and the solution should not have an unusual color. Some care is required to see that there is not a fine precipitate in the solution. If there is, the solution should not be used.

Technique of injection, neoarsphenamine, standard instructions.—How important are some of the points laid down in the standard instructions regarding the technique of injecting the drug is not yet known. Nevertheless, bad technique probably has had a good deal to do with some serious reactions. At least it was so considered when the standard instructions for the preparation and intravenous administration of arsphenamine and neoarsphenamine were drawn up in 1922 and issued for use by the medical departments of the Army, Navy, and Veterans' Bureau, and by the United States Public Health Service. Evidence is obtained from time to time that some medical officers are not following those instructions. The instructions are mandatory. They should be followed, even though

it is true that one may depart from them in one particular or another for hundreds or thousands of doses without happening to encounter a dangerous or fatal reaction. The technique should be absolutely standardized, if for no other reason than for the help that would be given by knowing that uniformity prevailed in judging the behavior of different lot numbers and the toxicity of neoarsphenamine in general. It is probable that here and there solutions are injected which are more concentrated than permitted by the instructions, and that injections are given much more rapidly than they should be. Both of these points are probably of importance. Recently a medical officer had the experience of giving an intravenous dose of neoarsphenamine to a patient who had received injections earlier at another station. The instructions were followed regarding dilution and time of injection. The man was a little impatient and remarked, "They would have had four men shot in this time at ——." A chief pharmacist's mate who formerly had duty on board a destroyer in the Asiatic Fleet stated that it was customary for chief pharmacists's mates to administer the drug intravenously. It was brought out in conversation that the prescribed technique was not followed and that injections were given rapidly.

Arsphenamine.—Arsphenamine is more stable than neoarsphenamine and may be expected not to deteriorate with age under ordinary conditions of storage. It has been found in the United States Hygienic Laboratory that samples of most old lots of arsphenamine upon retest were no more toxic for rats than when first examined. This statement applies to lots 6 years old. Certain lots more than 10 years old have shown no increase in toxicity for rats. Therapeutic activity is an important consideration as well as toxicity. There is not sufficient evidence as to whether the therapeutic value of arsphenamine is lowered by keeping it for several years, but there is no definite evidence that the therapeutic activity is reduced with age. It is not unlikely, however, that arsphenamine of better quality and higher potency is now being manufactured than in earlier years. Everything considered, it appears advisable not to use arsphenamine that is more than 3 years old. As in the case of neoarsphenamine, the United States Naval Medical Supply Depot, Brooklyn, N. Y., now purchases only freshly manufactured lots so that material not over 6 or 8 months old is sent to the other supply depots.

Causes of severe reactions (arsphenamine) other than hypertoxicity of the drug.—Every person has a certain tolerance for arsenic in the form of arsphenamine or neoarsphenamine. There is a good deal of evidence to show that individuals differ greatly in tolerance. There is evidence also which indicates that small doses of a potent but not

unusually toxic lot of drug, frequently repeated, can by cumulative action cause acute or subacute poisoning by arsenic. It is not infrequently impossible when the report of an alleged severe reaction is studied to decide whether the drug was especially at fault, whether the technique was faulty, or whether the patient's tolerance was exceeded by earlier doses given at short intervals. As might be expected, medical officers do not, as a rule, report that the technique was bad. During the first few months after the collection of data was begun in December, 1924, it seemed to be the practice of nearly all medical officers to begin treatment with neoarsphenamine with a dose of 0.9 gram, regardless of the size of the patient or stage of the disease, and likewise to make every subsequent dose 0.9 gram. During the past year, according to monthly reports, more than 0.45 gram has rarely been injected as a first dose and often all or most doses in a course have been limited to 0.45 or 0.6 gram. A number of reports have seemed to indicate that several small doses given oftener than once a week have nevertheless caused arsenical poisoning, manifested by dermatitis or damage to the liver. In a case where an immediate shocklike reaction follows an intravenous dose, or acute encephalitis develops two or more days after the injection, it is difficult to decide whether the result was due principally to hypertoxicity of the drug or to idiosyncrasy on the part of the patient, and, of course, both elements may have entered into the case. Not infrequently, it would seem, severe reactions described were really Herxheimer reactions which depended upon the stage of the disease and the activity of the syphilitic infection, and would have occurred with any other lot number or make of neoarsphenamine which was therapeutically potent. It is not practicable to separate the various reactions and relegate them to type. Consequently, all reactions have been described as they occurred and the reader may draw his own conclusions as to significance.

SUCCINCHLORIMIDE PROPOSED AS A CHEMICAL AGENT FOR THE PREPARATION OF POTABLE WATER¹

By Maj. CYRUS B. WOOD, B. S., M. D., M. S., Medical Corps, United States Army

INTRODUCTION

The purpose of the work here reported was to find, if possible, a water disinfectant suitable for small-scale preparation of potable water that would be an improvement on the disinfectant used in the present official Army method for the preparation of potable water

¹ Department of Preventive Medicine and Clinical Pathology, Army Medical School, Washington, D. C. Reprinted from *The Military Surgeon*, vol. 63, No. 4, October, 1928. Bibliography omitted.

in the field. The work to date (January, 1927) is reported because of the appointment of a joint board representing both the Chemical Warfare Service and the Medical Department to continue that search.

HISTORICAL

A full account of the development of the various methods used to render water potable in quantities both large and small would be beyond the scope of this article. For such an account the reader is referred to the excellent work of Mason; a shorter account, dealing more in detail with the chlorine-containing compounds used in such work, is to be found in the book by Race. An excellent recent work discussing water disinfection is that by Buswell.

Suffice it to say that the discovery of the bacterial origin of many of our common diseases and the part played in the spread of these diseases by water and food resulted in the development of large-scale methods for the destruction of harmful bacteria in order that large water supplies might be delivered to the users in potable form. At the same time the purification of small supplies and of small quantities of water became urgent, and the armies of the civilized nations realized the need of such methods for the purification of water supplies in large and small camps and also out in the field, away from permanent and semipermanent camps.

The methods of use in the small-scale purification of water are to be found fully described and discussed in texts on hygiene, sanitation, and related subjects. Their development has, naturally, been influenced by the methods that proved of use in large-scale water disinfection; still, this small quantity problem has features that differ from large and from small scale water disinfection.

The simplest method of rendering water potable is boiling. Boiled water is, however, definitely unpalatable; furthermore, the boiling of water before drinking is seldom practicable in field use.

The next simplest method is the addition to water of a chemical or of chemicals, and several have been used in this way. Years ago potassium permanganate was used by the British; the dosage used varied with the water treated, and sufficient chemical was added until a pinkish tint remained for 20 or 30 minutes. Long ago, also, the British used bleaching powder; approximately 25 grams were added per water-cart quantity (about 100 gallons). Later, tablets of acid sulphate (sodium acid sulphate, with saccharin and oil of lemon) were used for single-canteen quantities. This last has the disadvantage, first, of attacking the metal of the canteen, and, second, of preventing much of the normal amount of calcium from being absorbed (hence is undesirable for continued use). Potassium permanganate

is said to be a specific destroyer of cholera organisms, but is far from being an active bactericidal agent for all organisms to be found in natural waters.

Col. C. R. Darnall, Marine Corps, designed a box filter, about the perforated siphon outlet of which is placed a cloth on which is caught freshly precipitated aluminum hydroxide. Water is run into this filter from a barrel set on a rack above it; below is placed a second barrel in which the filtered water is stored. This is a small-scale modification of the principle employed in rapid sand-filtration plants, use being made of an artificial *schmutzdecke*. This method is applicable to permanent and semipermanent camps but not to small, highly mobile bodies of troops.

Col. W. J. Lyster, Marine Corps, proposed the field method for preparing potable water that is the present official one. It consists in the use of a bag of special weave, of inverted-cone shape, with a capacity of 36 gallons (136 liters), equipped with 5 or 6 spring faucets near the bottom. It is mounted on a folding ring, this feature making for ready transportability, and weighs, empty, less than 8 pounds. With the bag is furnished a filtering cloth, allowing rough filtration to the extent of removal of sticks, leaves, and larger suspended particles. The disinfecting agent used is bleaching powder, which is issued in 1-gram quantities in sealed brown-glass tubes; lots of these tubes in cardboard boxes are issued by the Quartermaster Corps, as are also the bags.

For use the bag is suspended and filled, through the filtering cloth if necessary, with water. One or more (the number to be directed by a Medical Corps officer) tubes of bleaching powder are broken and the contents shaken into a cup containing a little water. This mixture is stirred, made gradually thinner with more water, emptied into the bag, and the whole stirred well. After standing 30 minutes the water is considered potable.

One tube of bleaching powder containing 1 gram of that compound added to a Lyster bag (36 gallons, or 136 liters) of water is a dosage of 7,353 milligrams per liter, or 7.353 parts per million. The chlorine dosage depends upon the titer of the powder at time of use; if (for the sake of simplicity) its titer is 27.2 (i. e., 1 gram furnishes 0.272 grams available chlorine), the addition of one tube of this powder to a Lyster bagful of water means the addition of 272 milligrams available chlorine to 136 liters, or 2 milligrams per liter, or two parts per million. If the bleaching powder has a titer of but 13.6, a tube of such powder to this quantity of water is the use of a dosage of one part per million available chlorine.

This method was used extensively during the World War, and the correspondence on it in the Surgeon General's Office deserves mention. First, in point of time, should be mentioned the confusion that

was almost inevitable because of the fact that this bag and its accompanying filter and the bleaching-powder tubes were and are issued by the Quartermaster Corps. The supervision of the bleaching-powder treatment was a function of the Medical Department, and it was thought by many units that the powder was supplied by the Medical Department.

More important is the fact that bacteriological checks of the bleaching powder on hand showed such unsatisfactory and erratic bactericidal power as to render necessary a physical inspection of the stocks of tubes delivered overseas. These examinations showed the tubes themselves to be in unsatisfactory physical condition, unreasonably large percentages of poorly sealed and of exploded tubes being found. Poor packing also was found, the separate containers (each at that time holding 60 tubes) not being well enough filled with both tubes and packing to prevent injury to the tubes especially in the top and bottom layers incident to the hurried handling they had received. Chemical examinations of the bleaching powder held in tubes picked at random from large stocks showed the available chlorine content to be unreasonably low.

Meanwhile the best use was being made of the bleaching-powder tubes on hand, Medical and Sanitary Corps officers recommending often as many as five tubes to be used to each Lyster bag full of water. Such a water has, of course, a definite taste, and was quite naturally blamed for any physical ills that might develop within the next several hours, days, and even weeks subsequent to its use.

In 1921 the Surgeon General interested the Quartermaster General in the condition of the supplies of bleaching-powder tubes on hand, and through that office sample boxes from the several storage depots were sent in for examination. As a result of this survey recommendations as to more careful packing were made, and a deterioration rate of the bleaching powder in these tubes of approximately one-sixtieth (0.5 of the original titer of 30 to 32 per cent) per month was determined. In this connection it is interesting to know that McConnell and Hart have announced a monthly deterioration rate of commercially packed bleaching powder of 1.08 per cent of its original 30 to 35 per cent free chlorine content.

Fairhall suggested adding to the equipment for the field preparation of potable water, ampoules containing a solution of orthotolidin and clear glass tubes holding each 1 gram of small sodium thiosulfate crystals; he recommended the modification of the original procedure described above by adding to the water under treatment a sufficient number of tubes of the bleaching powder on hand to give a color with the orthotolidin solution which persists for 30 minutes, then adding the sodium thiosulfate crystals, stirring well, and pro-

nouncing potable very soon after this last step. These recommendations were later adopted.

Hitchens made useful observations on the shades of color given by the orthotolidin solution recommended by Fairhall, proposed more specific directions, and placed emphasis again on the use, in the absence of other methods, of tincture of iodine in the dosage of one drop to a canteen full (this equals approximately one drop per liter) to render water potable.

In their extensive study of a large number of compounds and mixtures containing free or available chlorine as antiseptics Dakin and his coworkers found that the compound p-dichloramino-sulfon benzoic acid can be used as a small-scale water disinfectant. This compound is now on the market under the name "halazone"; it is put up in tablets, each for the treatment of a quart or a liter of water; each tablet contains 4 milligrams of that compound. This is, the writer believes, the first proposal of the use of an organic compound containing positive chlorine for water disinfection.

A study was made of 30 bottles (each containing 100 tablets) of "halazone" and these tablets were found to deteriorate at the rate of approximately 10 per cent yearly; each tablet containing 4 milligrams "halazone" to-day will be found a year from now to contain but 3.6 milligrams.

While this study was in progress tablets were furnished by the manufacturer of a preparation known as "nuklorene," in the hope that it would prove useful as a water disinfectant. It was worthless bactericidally. The writer mentions this incident because of his strong suspicions that the active principle of this preparation was sodium p-toluene sulfon-chloramide (chloramine-T); if this is correct, it constitutes a second proposal of an organic compound as a water disinfectant. This last-named compound was announced useless as a water disinfectant by Dakin and Dunham.

More recently Maj. C. H. H. Harold, of the Royal Army Medical Corps, has proposed and developed a method for the preparation of small quantities of potable water that seems to answer the field problem quite well. He uses as the disinfectant agent chloramine, NH_2Cl , which will be found discussed at some length by Race and is used for large-scale water disinfection in some cities on this continent. Referring the reader to Harold's articles for the details of this method, the writer must state for the sake of completeness that Harold recommends the forming of chloramine or of dichloramine (NHCl_2) by adding to the water under treatment first a tablet of ammonium carbonate, then a small volume of chlorine water. The compounds named are formed promptly, depending upon the use of one or of two volumes of chlorine water to a unit quantity of am-

monium carbonate. Certain advantages of this method are obvious; the materials are quite available and are cheap; the method is not at all complicated; the disinfecting agent is formed right in the water treated, hence its deterioration does not enter into the problem. However, the stability of the ammonium carbonate tablets and of the chlorine water must be considered; furthermore, the 2-reagent feature of this system will, the writer fears, be considered by many a real disadvantage.

THEORETICAL

To be of use for the Army method of preparing potable water in the field an organic compound containing positive chlorine must be a solid at ordinary temperatures and pressures. A liquid compound of this nature would have certain disadvantages, in that it would escape readily from its container, once that container became cracked (not necessarily broken), and would react with water sufficiently promptly to show corrosive properties more or less readily. A gas would escape, possibly explosively, from its container were that container handled too roughly; furthermore, for the use of a gas an apparatus would be needed differing from the present equipment.

Such a solid organic compound containing positive chlorine should possess the following properties:

1. Prompt reaction with water, with resulting prompt bactericidal action on the organisms encountered in natural waters.
2. Stability to a degree allowing prolonged storage; slight or negligible deterioration for a period of time expressible in years rather than in weeks or months.
3. Nontoxic action on the human body.

Bleaching powder (calcium chloro-hypochlorite) in the form of the ordinary grades (titer 30 to 35; 30 to 35 per cent available chlorine) has been found definitely wanting in the second characteristic, stability. *p*-dichloraminosulfon benzoic acid, "halazone," has the first characteristic to an imperfect degree, reacting so slowly with water that it has been found necessary to put in its tablets a quantity of sodium carbonate or of sodium borate equal to the weight of that compound in order to make its solubility in water near a practical degree.

Sodium toluene *p*-sulfonchloramide, chloramine-T, the water soluble wound disinfectant developed by Dakin and coworkers, has too slow a bactericidal action to be of any use as a water disinfectant.

Some readers may wonder, as did the writer, about the bactericidal power of benzene sulfondichloramide, $C_6H_5SO_2NCl_2$, a compound closely related chemically to chloramine-T and dichloramine-T. The writer made a few grams of this compound (October, 1926) and found that a few tiny crystals scattered on the surface of water

containing a very little potassium iodide, liberated free iodine promptly. Some of this compound was accordingly sent for bacteriological study, and was reported too sluggish bactericidally to deserve the name of a water disinfectant.

The writer attempted the preparation of tetrachlorohexamethylenetetramine and of monochloroguanidine without success; hence can make no statement as to the degree to which each of these compounds possesses the characteristics mentioned above.

Personal communication with Dr. T. J. Albert (formerly with the Medical Research Division, Edgewood Arsenal, Md.) makes the writer doubt the stabilities of acetylchlorocarbamide and of most, if not of all, of the interesting series of substituted ureas developed by Chattaway and his coworkers.

The writer's attention was attracted to the compound succinchlorimide primarily because it resembles phthalic acid in imide formation, anhydride formation, and other ways. The salts of succinic acid are to be found in certain nonpoisonous fruits, such as lettuce and unripe grapes. Furthermore, the sodium, potassium, and ammonium salts of succinic acid have been used in medicine as internal remedies, in dosages of 5 to 15 grains (0.3 to 1 gram). Succinchlorimide reacts with water to form a simple amino acid, succinamic acid; hence, the prospects of this compound being of low toxicity seemed quite good.

The preparation of this compound, stability studies, toxicity studies, and bacteriological studies made on this compound will be given later. (See Experimental.)

Compounds containing positive chlorine are believed to act bactericidally in the threefold manner; they act—(I) by directly oxidizing organic matter; (II) by directing chlorinating organic matter; and (III), by toxic action on such low forms of life. The writer doubts that it will ever be possible to separate these actions, as the temperatures and humidities demanded by such forms of life leave little room for varying experimental conditions sufficiently to rule out either of the first two actions named.

PROPERTIES

Succinchlorimide is a crystalline compound, colorless, with slight odor of chlorous nature that is not at all strong in crystals of the highest purity. It has a melting point of 148° to 149° C. and can be fused and allowed to solidify repeatedly, apparently without change, under temperatures of 170° C.; above that temperature it decomposes.

It has a somewhat saline taste with a definite chlorous quality that is moderately persistent.

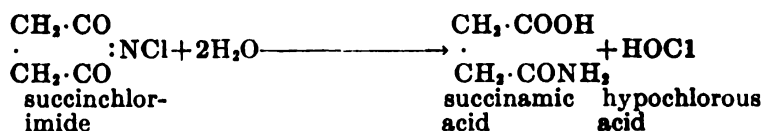
Succinchlorimide dissolves quite readily in water, especially if in finely divided state, to make approximately a 1 per cent solution

(20° C.). It is fairly soluble in chloroform and in ethylene chloride (symmetrical dichloroethane), and sparingly soluble in benzene, toluene, and acetylene tetrachloride (symmetrical tetrachloroethane) at ordinary temperatures. All of the solvents just named dissolve this compound in appreciable quantities when hot, and can be used as recrystallizing solvents.¹ Oddly, succinchlorimide is practically insoluble even in hot carbon tetrachloride.

Acetone and ethyl acetate dissolve this compound in fair quantities at ordinary temperatures, apparently without change.

Methyl alcohol seems to dissolve succinchlorimide without change; such a solution, on being evaporated to dryness, leaves a residue that appears unchanged. Such can not be said of ethyl alcohol, however; a reaction takes place at temperatures near 50° C. which may be quite brisk, and the residue gives no evidence of containing available chlorine.

As would be expected in the case of a compound containing positive chlorine, aqueous solutions of this compound react promptly with potassium iodide, liberating free iodine. The compound succinchlorimide reacts with water according to the reaction:



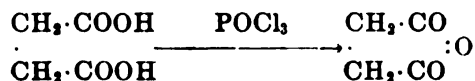
The simple amino acid formed on hydrolysis probably explains the low toxicity of this compound.

EXPERIMENTAL

A. PREPARATION OF SUCCINCHLORIMIDE

1. (a) Preparation of succinimide by treating succinic anhydride with dry ammonia.

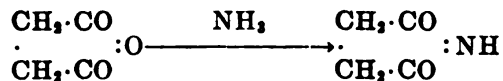
One hundred grams succinic acid, dried at 100° C., are heated in 300 cubic centimeters retort with 65 grams phosphorus oxychloride at a temperature of 100 to 120° C. until hydrogen chloride is no longer evolved; during this step the stem of the retort is elevated to serve as a reflux condenser. After hydrogen chloride is no longer evolved the stem of the retort is lowered and the contents distilled; the distillate is collected after each single drop solidifies (first few drops discarded). The product is succinic anhydride practically pure; recrystallization from chloroform gives a product melting at 119 to 120° C. Reaction:



One hundred grams succinic anhydride are fused in a 300 cubic centimeter retort and a stream of ammonia gas is led through a column of soda lime into it until the ammonia is no longer absorbed (odor). The stem of the retort elevated during this step, is then lowered and the contents rapidly distilled over

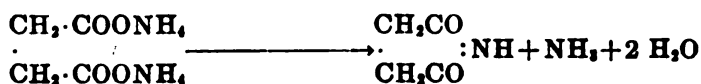
¹ The writer plans soon to determine more accurately these solubilities.

a free flame. (Previous heatings of the retort are done on a sand bath or a Wood's metal bath.) A certain amount of charring seems unavoidable in this step; the distillation is accordingly stopped as soon as the distillate, at first clear and colorless, becomes slightly discolored (yellowish). Recrystallization of this product from acetone gives a product melting at 123 to 125° C. Reaction:



1. (b) Preparation of succinimide from ammonium succinate.

Crystallized or powdered ammonium succinate is placed in a round-bottomed flask or in a retort in sufficient quantity to fill it half or a bit more. If a flask is used, it is fitted with a single outlet tube of wide diameter. Heat is applied (free flame) so as to get rapid and uniform temperature rise. The contained ammonium succinate melts, then ammonia and steam are evolved and succinimide distills over. By rapid heating very little loss from charring occurs. Reaction:

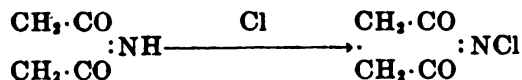


(The writer has repeatedly tried the method of heating ammonium succinate in an open dish to temperatures near 200° C., and reports most erratic results.)

2. Preparation of succinchlorimide from succinimide.

The preparation of succinchlorimide by adding chlorine gas and also by adding a strong solution of bleaching powder to a solution of succinimide in 15 per cent sodium hydroxide at low temperatures (0° to 10° C.) was unsuccessful in the writer's hands.

The writer has been able to prepare succinchlorimide by passing a slow stream (separate bubbles at a rate allowing counting) of chlorine gas into water containing approximately 5 per cent of succinimide and 5 per cent of sodium bicarbonate or 3 per cent sodium carbonate, the solution being chilled to temperatures below 10° C. The succinchlorimide forms quite promptly in solutions made with sodium bicarbonate, and after some delay in solutions with sodium carbonate it collects at the surface of the solution as a white crystalline product. Recrystallization from chloroform, ethylene chloride (symmetrical dichloroethane), acetylene tetrachloride (symmetrical tetrachloroethane), benzene, or toluene gives a product that contains the theoretical amount of chlorine (26.560 per cent) and that melts at 148 to 149° C. Reaction:



B. STABILITY OF SUCCINCHLORIMIDE

The many factors influencing the rate of deterioration of chemical compounds need but be mentioned to show how complex a subject this is and how many-sided a study could be made of this or of any compound. The purity of the compound, the nature of the impurities (if any are present), the degree of access of air, the qualities of the air that may gain access to it, the range of temperatures to which it may be subjected in storage, the accessibility of light, the character of that light—these are the most obvious factors in-

fluencing the deterioration of chemicals. The following brief studies were made, choosing them because of the factors that have undoubtedly played a part in the deterioration of bleaching powder.

1. Under steadily changing air of 50 per cent humidity and exposure to northern light for 50 days bleaching powder, "halazone" and succinchlorimide were studied with the following results:

	Bleaching powder	"Halazone"	Succin- chlorimide
Per cent free Cl, 0 day.....	21.9	25.5	25.6
Per cent free Cl, 50 days.....	16.9	25.06	25.4
Loss.....	5.0	0.44	0.2
Per cent original Cl lost.....	22.8	1.72	0.78

(The analyses given represent titrations of 0.100 gram samples with thiosulfate solution. Each figure is the average of three titrations of such samples. The powders were thoroughly mixed before collecting these samples.)

2. Samples of "halazone" and of succinchlorimide were studied in clear glass tubes, cotton plugged; each tube was about half filled with contents. Half of these tubes were placed in a bacteriological incubator where a temperature of 37.5° C. was maintained for 50 days. The remaining tubes were kept on the shelf close to a north window (no direct sunlight) for the same period.

	Halazone		Succinchlorimide	
	Room tem- perature, light	Incubator, dark	Room tem- perature, light	Incubator, dark
Per cent free Cl, 0 days.....	24.0	24.0	25.6	25.6
Per cent free Cl, 50 days.....	23.65	23.0	25.55	25.6
Loss.....	0.35	1.0	0.05	0.0
Per cent original Cl lost.....	1.46	4.16	0.195	-----

The succinchlorimide loss at room temperature in the above table is within the limits of experimental error, as is the figure of 25.7 per cent free chlorine given on analysis of other portions of this same sample at an age of 200 days (June 22, 1926, to January 8, 1927).

3. Capt. D. W. Fetterolf, retired,¹ found that approximately 0.5 gram quantities of this compound that had been kept in formalin-hardened gelatin capsules sealed with a gelatin solution in an ice box ($\pm 40^{\circ}$ F.) for one year showed a chlorine content at the end of that period of 26.10 per cent (theoretical, 26.56).

4. The writer has a bottle containing about 65 grams of this compound that he made during the summer of 1926. This bottle has been about the laboratory and, for several months, on a certain desk in the Surgeon General's office since that time. It has had no special

¹ Officer in charge, chemical laboratory, Army Medical School, 1923-1927.

care or attention, except that it has never, it is believed, been exposed to direct sunlight. It has never been in an ice box. Its stopper has never been out for more than a few moments at a time. Recently (May 31, 1928) an analysis showed the presence of 26.08 per cent chlorine; it is still better than 98 per cent pure, based on its chlorine content.

The facts given in the preceding numbered paragraphs all suggest an excellent degree of stability of the compound succinchlorimide, making all due allowances for the facts that it is organic, that it contains positive chlorine in a comparatively small molecule, and that it reacts quite readily with water. It is definitely more stable than "halazone," which compound was used not only as one possessing a stability that would be of value for comparison, but also as one whose stability should be exceeded by the compound sought for in this study.

C. BACTERICIDAL POWER OF SUCCINCHLORIMIDE

The figures in the following table are from the report by Capt. W. C. Cox, Medical Corps, to the director of laboratories, Army Medical School, in February, 1926. They show the fact that the first small lot of succinchlorimide examined deserves the name of being a water disinfectant.

Sterile distilled water plus B. coli

	Tests for the presence of B. coli												Precipitate	Bacteria per cubic centimeter
	Fermentation tubes						Confirmatory E. M. B. plates							
	24 hours			48 hours			24 hours			48 hours				
	0.1	1.0	10	0.1	1.0	10	0.1	1.0	10	0.1	1.0	10		
Control.....	+	+	+	+	+	+	@	@	@	@	@	@	Very faint.....	3,000
Ca-2.....	○	○	○	○	○	○	○	○	○	○	○	○	Very faint.....	
SCI-5.....	○	○	○	○	○	○	○	○	○	○	○	○	Very faint.....	
SCI-10.....	○	○	○	○	○	○	○	○	○	○	○	○	Very faint.....	
SCI-5-m.....	○	○	○	○	○	○	○	○	○	○	○	○	Very faint.....	
SCI-10-m.....	○	○	○	○	○	○	○	○	○	○	○	@	Very faint.....	

Water from Rock Creek

Control.....	+	+	+	+	+	+	@	@	@	@	@	@	Slight.....	6,000
Ca-2.....	○	○	○	○	○	○	○	○	○	○	○	○	Slight.....	
SCI-5.....	○	○	○	○	○	○	○	○	○	○	○	○	Slight.....	
SCI-10.....	○	○	○	○	○	○	○	○	○	○	○	○	Slight.....	
SCI-5-m.....	○	○	○	○	○	○	○	○	○	○	○	○	Slight.....	
SCI-10-m.....	○	○	○	○	○	○	○	○	○	○	○	○	Slight.....	

Ca=Commercial grade bleaching powder.

SCI=Succinchlorimide.

numbers=Dosage in milligrams per liter.

m=Mixture with equal weight sodium carbonate.

○=No bacterial growth.

+=Bacterial growth.

@=Presence of B. coli.

¹ Rock Creek water turbid before addition of chemicals; turbidity difficult to read.

This work has been repeated and extended by Maj. J. S. Simmons, Medical Corps, using the compound prepared by the writer, and his results will be included in the report of the board. (See Introduction.)

D. TOXICITY OF SUCCINCHLORIMIDE

Reference must again be made to the future report of the board for details of toxicological studies already performed or under way. The writer directed the first series, and states here only that the first series of dogs used suggests a very low degree of toxicity for dogs on internal administration; a minimal lethal dose of one gram per kilogram body weight, or a higher figure, is predicted.

One case of prolonged human exposure should here be mentioned. The writer himself has been more or less actively engaged in the study and in (practically unaided) the manufacture of this compound for over two years. He has had it on his hands and arms to the elbows for hours at a time almost weekly during this period. If this compound were in any way toxic on such continued contact, he should have experienced such ill effects. There have been none. This is, however, but one case.

DISCUSSION

A water disinfectant that is stable and that will render water potable not only in quantities such as are held in a Lyster water bag, but in smaller quantities, such as are held in the canteen carried by the individual soldier, is one in which the Army is interested. The preparation of smaller tablets of this compound is under consideration by the board now organized, with the hope that such use of this compound may be made. The question of injury to the human body on long use of this compound is also to be studied.

The development of the automobile within the memory of all readers has created an extragovernmental interest in such a tablet for the use of tourists and campers, whose vacation activities are much more general than they were even but a few years ago. Interest may also develop from intelligent inhabitants of tropical and subtropical regions, while the usefulness of such a compound to the personnel of expeditions to unexplored regions is obvious.

SUMMARY

The properties desired in a compound suitable for the preparation of small quantities of potable water are discussed.

Succinchlorimide is a compound that seems to possess these properties.

ACKNOWLEDGMENT

Acknowledgment is due first to the Surgeon General's office for the utmost encouragement and support in this work. Lieut. Col. J. F. Siler, Medical Corps, of that office, has been personally interested in it and has assisted the writer especially in allowing access to the correspondence on this subject in that office, and by furnishing him copies of much of that correspondence.

Acknowledgment is here made of the cooperation of the Army Medical School in the bacteriological work reported.

Further acknowledgment is due to Col. H. L. Gilchrist, Medical Corps, Chief of the Medical Research Division at Edgewood Arsenal, Md., at the time of the start of the work with the compound chiefly dealt with above. The hearty cooperation of the following Chemical Warfare Service personnel is here acknowledged in the several conferences held: Of the Chemical Division, Drs. G. E. Miller, R. L. Sebastian, J. Reichert, and Mr. R. W. Peakes; of the Medical Research Division, Mr. T. P. Dawson; formerly with the Medical Research Division, Dr. T. J. Albert.

The Dow Chemical Co. kindly furnished a generous sample of acetylene tetrachloride for this work.

EXPERIMENTS WITH SUCCINCHLORIMIDE CONDUCTED AT THE UNITED STATES NAVAL MEDICAL SCHOOL DURING APRIL, 1928

A sample of succinchlorimide recrystallized in August, 1927, when it was said to have shown 26.5 per cent of available chlorine, was obtained from Maj. Cyrus B. Wood, Medical Corps, United States Army, of the Army Medical School. This sample, a white crystalline substance, had been kept in an amber-colored glass bottle with an ordinary cork stopper. It was assayed by C. Schaffer, chief pharmacist, United States Navy, at the Naval Medical School on April 6, 1928, or approximately eight months after recrystallization, and found to contain 25.5 per cent of available chlorine, a deterioration of 0.1 per cent.

On April 20, 1928, bacteriological tests were made under the direction of Lieut. Commander John Harper, Medical Corps, United States Navy. In these tests 1 cubic centimeter of a 24-hour broth culture of the *B. coli* was added to each flask of two series of five 1,000-cubic centimeter flasks. One series was filled with sterile distilled water and the other with water taken from the Potomac River at Hains Point, which is just below the city of Washington, D. C. One flask from each series was used as a control. Succinchlorimide, 25.5 per cent available chlorine, was added in amounts of 5 milligrams and 10 milligrams, respectively, to each of two flasks, and amounts of

chlorinated lime calculated to contain available chlorine equivalent to that in the succinchlorimide, namely, 6 milligrams and 12 milligrams, respectively, were added to the remaining two flasks of each series. After a holding time of one hour water from each flask in amounts varying from 0.1 cubic centimeter to 10 cubic centimeters was inoculated into a series of fermentation tubes and plates of Endo's medium. The results after 24 and 48 hours' incubation, respectively, at 37° C. are shown in the following table:

Sterile distilled water plus B. coli

	Tests for presence of B. coli											
	Fermentation tubes						Endo plates					
	24 hours			48 hours			24 hours			48 hours		
	0.1	1.0	10	0.1	1.0	10	0.1	1.0	10	0.1	1.0	10
Control.....	+	+	+	+	+	+	(+)	(+)	(+)	(+)	(+)	(+)
SCI-5.....	-	-	-	-	-	-	-	-	-	-	-	-
SCI-10.....	-	-	-	-	-	-	-	-	-	-	-	-
CL-6.....	+	+	+	+	+	+	(+)	(+)	(+)	(+)	(+)	(+)
CL-12.....	A	+	+	+	+	+	(+)	(+)	(+)	(+)	(+)	(+)

Potomac River water (Hains Point) plus B. coli

Control.....	+	+	+	+	+	+	(+)	(+)	(+)	(+)	(+)	(+)
SCI-5.....	A	A	+	+	+	+	-	-	-	-	-	-
SCI-10.....	+	A	+	+	+	+	(+)	(+)	(+)	(+)	(+)	(+)
CL-6.....	+	+	+	+	+	+	(+)	(+)	(+)	(+)	(+)	(+)
CL-12.....	+	+	+	+	+	+	(+)	(+)	(+)	(+)	(+)	(+)

SCI=succinchlorimide.

CL=chlorinated lime.

+ =acid and gas.

A =acid only.

-- =no acid or gas.

On April 26, 1928, tests were again made under the same technique as that outlined above with sterile distilled water plus *B. coli*, Potomac River water from Hains Point, Rock Creek water, and Rock Creek water plus *B. coli*. The results are given in the following tables:

Sterile distilled water plus B. coli

	Tests for presence of B. coli											
	Fermentation tubes						Endo plates					
	24 hours			48 hours			24 hours			48 hours		
	0.1	1.0	10	0.1	1.0	10	0.1	1.0	10	0.1	1.0	10
Control.....	+	+	+	+	+	+	(+)	(+)	(+)	(+)	(+)	(+)
SCI-5.....	-	-	-	-	-	-	-	-	-	-	-	-
SCI-10.....	-	-	-	-	-	-	-	-	-	-	-	-

Potomac Water—plain (Hains Point)

	Tests for presence of <i>B. coli</i>											
	Fermentation tubes						Endo plates					
	24 hours			48 hours			24 hours			48 hours		
	0.1	1.0	10	0.1	1.0	10	0.1	1.0	10	0.1	1.0	10
Control.....	+	+	+	+	+	+	(+)	(+)	(+)	(+)	(+)	(+)
SCI-5.....	-	G	G	-	G	G	(+)	M	M	(+)	M	M
SCI-10.....	-	-	-	-	-	-	(+)	M	M	(+)	M	M

Rock Creek water—plain

Control.....	+	+	+	+	+	+	(+)	(+)	(+)	(+)	(+)	(+)
SCI-5.....	-	G	G	-	G	G	(+)	M	M	(+)	M	M
SCI-10.....	-	-	-	-	-	-	(+)	M	M	(+)	M	M

*Rock Creek water plus *B. coli**

Control.....	+	+	+	+	+	+	(+)	(+)	(+)	(+)	(+)	(+)
SCI-5.....	-	G	G	-	G	G	(+)	M	M	(+)	M	M
SCI-10.....	-	-	-	-	-	-	(+)	M	M	(+)	M	M

SCI=succinchlorimide.

+ =acid and gas. Positive for *B. coli*.

- =no acid or gas.

G =growth without acid or gas formation.

M =abundant growth of molds, no acid or gas formation. Negative for *B. coli*.

Water from Potomac River and Rock Creek, as shown in the above tables, gave abundant growths of numerous moulds. It was noted that moulds apparently inhibited the growth of *B. coli* and vice versa.

Finally, to test the palatability of water treated with succinchlorimide, a 5-gallon cooler was filled with tap water to which succinchlorimide was added in the proportion of 10 milligrams to the liter. This cooler was placed in the laboratory and volunteers were called for from among the laboratory staff to drink the water. After two days many of the volunteers objected to the taste of the water. Sodium thiosulphate was then added to the water in the proportion of 5 milligrams per liter, or 0.72 gram to 36 gallons, the capacity of a Lyster bag, with the result that the disagreeable chlorine taste persisted. When, however, the proportion of sodium thiosulphate was increased to 10 milligrams per liter, or 1.44 grams per 36 gallons, the taste entirely disappeared.

CONCLUSIONS

1. Bacteriological examination shows succinchlorimide a more efficient chemical disinfectant of water in small quantities than chlorinated lime.

2. The action of succinchlorimide on *B. coli* in distilled water was excellent in both 5 and 10 milligram per liter quantities after a time interval of one hour.

3. The effect of succinchlorimide on *B. coli* in water containing organic matter is interfered with, although not to the same extent as in the case of chlorinated lime.

4. It was interesting to note that in Potomac River and Rock Creek water on plates showing a wealth of mould growth, *B. coli* were few or absent and, conversely, plates with numerous *B. coli* had few or no moulds.

THE MINIMAL "CHLORINE DEATH POINTS" OF BACTERIA (VEGETATIVE FORMS)¹

FRED O. TONNEY, M. D., FRANK E. GREER, and T. F. DANFORTH, D. V. M., Bureau of Laboratories and Research, Department of Health, Chicago, Ill.

Although chlorine gas is universally used in the treatment of water supplies, and its derivatives are finding an ever-increasing field of usefulness in the disinfection of milk and beverage bottles, dishes, and utensils of various kinds, little is known of the actual or relative amounts of chlorine required to kill specific species of organisms under given conditions. The amount of available chlorine used in practical chlorination has been arrived at empirically or indirectly, and in many instances is probably far in excess of the amount actually needed to destroy the pathogen under consideration. The amount of chlorine required to obtain satisfactory results varies with many factors, and especially with the kind of fluid or material to be sterilized.

Little, if any, work has been done to determine the least amount of chlorine required to kill known numbers of known species of bacteria under fixed conditions that admit of comparison of their relative resistance.

It has not been determined definitely what organism may be considered a safe index of effective chlorine treatment or whether a given organism can be used as an index under different conditions. *B. coli* has been almost universally accepted as the index of safety in the treatment of water supplies. Its acceptance, however, has been based largely on theoretical considerations and on the analogy of its greater resistance to heat and longer survival than the common pathogens which may be present in water.

For these reasons it was considered desirable to study the effect of chlorine on specific bacteria under controlled conditions to determine, if possible, the minimal dosage of free chlorine required to kill

¹ Reprinted from American Journal of Public Health, October, 1928.

specific species of bacteria, to ascertain their relative resistance to free chlorine and, on the basis of these factors, to select, if possible, an organism that could be used as a safe index of effective chlorine disinfection.

In this article the methods used and results obtained with vegetative forms of bacteria are presented.

The methods of preparing the materials for the determinations were as follows:

The chlorine solution used was prepared by adding gaseous chlorine to distilled water until a final concentration of 60 p. p. m. of residual free chlorine was obtained. This served as a stock solution and was stored in a brown bottle in an icebox. At frequent intervals the free chlorine content of the solution was determined, and approximately every two weeks during the experiment a new stock solution was prepared.

The organisms tested included the common intestinal forms, and other pathogenic and nonpathogenic organisms, numbering in all 235 strains.

The intestinal organisms and *B. proteus*, *B. prodigiosus*, and *B. pyocyaneus* were grown on agar slants. *Cl. welchii* was grown in glucose broth under anaerobic conditions. The streptococci and pneumococci were grown either in glucose broth or in a special streptococcus broth. The staphylococci were grown in glucose broth and the diphtheria organisms were grown in glucose broth, ascites fluid, or serum glucose broth.

The cultures were centrifuged, washed, and resuspended three times in sterile distilled water. They were then diluted in sterile distilled water until a suitable number of organisms per cubic centimeter were present.

The exposures to chlorine were made in sterile distilled water as a menstruum. One hundred and fifty cubic centimeters of distilled water were placed in Pyrex Erlenmeyer flasks, and the contents and flasks were sterilized in an Arnold sterilizer. After the flasks had cooled to room temperature, 50 cubic centimeters of the water in each flask were removed and the chlorine-absorbing properties determined. Those flasks containing water showing any appreciable absorption were discarded. The remaining flasks were used for the experiments. The pH value of the water used ranged from 6.4 to 7.2. It is probable that the elimination of the water showing chlorine absorption also eliminated water of low or high pH value.

The tests were carried out by adding approximately 100 to 300 organisms per cubic centimeter to the contents of each of two flasks. From one flask 1 cubic centimeter was planted to determine the number of organisms present. Then a definite amount of free chlorine

was added to each of the flasks. One flask was immediately subjected to chemical analysis to determine the amount of residual chlorine present. The other flask was used for determining the rate of destruction of the organisms and the time required to kill. To do this 1 cubic centimeter of the contents was plated at intervals of 8-10 seconds, 15 seconds, 30 seconds, 45 seconds, and 60 seconds. The nutrient agar plates were poured immediately after transferring each 1 cubic centimeter portion from the flasks. These plates were incubated for 48 hours at 37° C. At the end of this time the plates were counted and the rate of destruction and time required to kill the organisms present recorded. It was found that 48-hour incubation was necessary, because in many instances numerous colonies appeared in 48 hours on plates which in 24 hours had no visible colonies. For the organisms that would not grow in plain agar, slight variations of the above procedure were used. With such organisms it was not possible to establish the rate of destruction by chlorine, as no satisfactory means of counting them was available, either before or after the addition of the germicide. It was only possible to determine the length of time required to kill all of the organisms. For this purpose the contents of the flasks were streaked or planted in the type of medium in which the organisms were originally grown. The experiments were carried out at temperatures ranging from room temperature to within a few degrees of the freezing point of water.

RESULTS

The results are shown in Table I. It will be noted that all strains of *B. typhosus*, *B. paratyphosus A*, *B. paratyphosus B*., *B. enteriditis*, *B. dysenteriae*, *B. suipestifer*, *B. proteus*, *B. prodigiosus*, and *B. pyocyaneus* were killed in 15 seconds by a dosage of 0.1 p. p. m. of free chlorine.

Many of the strains of streptococci of both hemolytic and fecal types were also killed by this amount of chlorine, as were all the strains of *Cl. welchii* (vegetative cells) and most of the strains of *C. diphtheriae*. In some instances slightly longer periods of time, i. e., 30 to 45 seconds, were required to kill all the organisms at the concentration of 0.1 p. p. m.

A few strains of pneumococci were slightly more resistant to chlorine than most of the other organisms. Four out of nine strains were killed by 0.1 p. p. m. of chlorine in 15 seconds. The remaining strains were killed by 0.2 p. p. m. of chlorine in less than 1 minute. The strains of *C. diphtheriae* not killed by 0.1 p. p. m. of chlorine were killed by 0.15 p. p. m. in 15 to 30 seconds.

TABLE I.—*Dosage of free chlorine required to kill vegetative cells of bacteria in 15–30 seconds*

Chlorine p. p. m.	Species	Number of strains	Species	Number of strains
0.10.....	<i>B. typhosum</i>	21	<i>B. pyocyaneus</i>	6
	<i>B. paratyphosum A</i>	6	<i>C. diphtheriae</i>	27
	<i>B. paratyphosum B</i>	6	<i>Achromo bacterium viscosum</i>	3
	<i>B. dysenteriae</i>	8	<i>Strep. scarlatinae</i>	14
	<i>B. enteritidis</i>	4	<i>Strep. fecalis</i>	11
	<i>B. proteus</i>	2	<i>B. suispestifer</i>	8
	<i>Cl. welchii</i>	8	<i>B. prodigiosus</i>	6
	<i>Bruc. melitensis</i>	1	<i>Bruc. abortus</i>	1
	<i>Staph. albus</i>	4	<i>Staph. aureus</i>	4
	<i>Pneumococcus</i>	4	<i>Strep. hemolyticus</i>	11
	<i>C. diphtheriae</i>	12	<i>Strep. morbilli</i>	2
	<i>Strep. scarlatinae</i>	6	<i>Staph. albus</i>	4
0.15.....	<i>Strep. fecalis</i>	2	<i>Pneumococcus</i>	5
	<i>Staph. aureus</i>	4	<i>B. coli (fecal)</i>	9
0.20.....	<i>Strep. hemolyticus</i>	10		
	<i>Pneumococcus</i>	4	<i>B. coli</i>	10
0.25.....	<i>Strep. hemolyticus</i>	3	<i>B. coli (fecal)</i>	9
			Total.....	235

Most of the strains of streptococci not killed by 0.1 p. p. m. of chlorine were killed by 0.15 or 0.20 p. p. m., although three strains were not killed until exposed to 0.25 p. p. m. of chlorine for 15 seconds to 30 seconds. These latter strains were of the hemolytic variety. Two were isolated from milk and one came from the Boston epidemic of streptococcus sore throat of 1911. It seems probable that the apparently higher resistance of these cocci to chlorine was due to the larger inoculum found necessary to obtain consistent growths. Considerably heavier inoculations of the streptococci were required than in the case of other organisms.

B. coli proved on the whole to be more resistant to free chlorine than the other organisms studied. None of the strains showed any appreciable reduction in number when exposed to 0.1 p. p. m. of chlorine. Nine strains were killed by 0.15 p. p. m. of chlorine, 10 strains required 0.2 p. p. m., and 9 required exposure for 15 seconds to 0.25 p. p. m. of chlorine for their complete destruction.

SUMMARY AND CONCLUSIONS

From these results it will be seen that a large majority of the vegetative types of organisms considered to be of sanitary importance in connection with water supplies, milk supplies, dish washing, bottle washing, and general disinfection, whether of intestinal or respiratory origin, are killed in a few seconds by rather small doses of free chlorine when exposed in a suspension containing no organic matter or other substances that react with or absorb the chlorine. This was found to be true for temperature ranges varying from room temperature to within a few degrees of the freezing point of water.

The amount of chlorine required to kill most of the intestinal pathogens studied under these conditions was 0.1 p. p. m., with the greatest destruction of the organisms occurring within the first 15 seconds of exposure. The same amount of chlorine destroyed most of the pathogenic types of respiratory organisms tested.

In each group, however, there were individual strains which were more resistant to chlorine than the others, requiring more than 0.1 p. p. m. to accomplish their destruction. In the intestinal group of organisms, the most resistant type encountered was *B. coli*. In the group of respiratory origin, three strains of hemolytic streptococci, out of 24 strains tested, required larger quantities of free chlorine for their complete destruction. All the resistant strains of streptococci were killed by 0.25 p. p. m. in 15 to 30 seconds. It is probable that the apparently higher resistance of the streptococcic strains is due to the larger number of organisms used in order to secure consistent growths.

From the standpoint of resistance to chlorine, *B. coli* stands out among the organisms tested as the most suitable for use as an index of the effectiveness of chlorine disinfection. The requisites of such an index organisms are: (1) That it be as resistant as, or somewhat more resistant to, free chlorine than the pathogenic organisms which are to be destroyed; (2) that it grow readily on simple media; (3) that it be readily recognizable by simple routine tests. From the standpoint of availability, rapidity of growth, and ready detection, *B. coli* offers superior advantages as an index organism, and it is our feeling that its consistent absence in a menstruum after chlorine disinfection is valuable evidence of the destruction of the pathogens here studied.

On the whole, the experiments appear to furnish a satisfactory theoretical basis for the current practice of relying on the consistent destruction of *B. coli* in water as a criterion of effective chlorination, and that they may also justify a more general application of the same criterion to other type phases of chlorine disinfection now being developed, such as the washing of milk bottles and equipment and the washing of dishes and eating utensils.

UNSATISFACTORY WATER SUPPLY, OLONGAPO, P. I.

By W. D. Davis, Lieutenant Commander, Medical Corps, United States Navy

The water supply of the native city and the United States Naval Station, Olongapo, P. I., is surface water collected on a watershed which consists of a valley belonging to the naval station. No one is allowed in the hills above the intake. Balfour, however, has pointed out that the protection of catchment areas in tropical countries is often very difficult, for it is not easy to control the movements of

natives and animals. Sometimes it is possible to fence the area, but a fence without a guard and without frequent inspection is often a broken reed. Heavy rains prevail in this section during a certain portion of the year and tend to wash any infective material into a creek which conducts the water to the intake located about 4 miles inland from the town. At this point there is a dam across the stream constructed so that the top forms a spillway for the surplus water which is wasted into the creek below. At one end of the dam, and extending into the stream from the shore, there is a covered concrete collecting reservoir. This reservoir has an intake opening equipped with a heavy iron grating in the upstream wall and another opening in the lateral wall through which the overflow is returned to the stream above the dam. The pipe line which conducts the water to the town and naval station enters through the downstream wall below the dam and is supplied with water from the reservoir.

In regard to quantity, the water impounded above the dam is more than sufficient for the naval station. The water is not filtered and during the dry season it is clear enough for drinking purposes. During the wet season it becomes muddy at times and, while no colon bacilli have been isolated, the bacterial count has reached the high figure of 27,450 bacteria per cubic centimeter.

When the writer arrived on this station, a chlorinating apparatus was in operation. This consisted of a tank of chlorinated lime solution with a syphon discharging near the end of the pipe line. During the rainy season the water in the stream increases to such an extent that it often flows over the top of the reservoir so that only a small amount of the contained water reaches the pipe line and distributing system. During the dry season, the water in the reservoir comes for the most part from the edge of the stream where the flow is retarded, and is more or less stagnant. Under these conditions, the chlorinating system as installed and operated was useless and this conclusion was confirmed by bacteriological examinations made at that time. Moreover, it gave the people a false sense of security and the chlorination of the water was therefore discontinued.

On August 14, 1928, samples of water were collected from the middle of the stream "A" and from the reservoir "B" under sterile conditions and were immediately packed in ice for transportation to the laboratory. (Fig. 1.) Bacteriological examination of these samples showed 8,000 colonies per cubic centimeter and positive presumptive tests for colon bacilli in both 1 cubic centimeter and 10 cubic centimeter amounts of water taken from the middle of the stream and 17,740 colonies per cubic centimeter and positive presumptive tests in both 1 cubic centimeter and 10 cubic centimeter amounts of water from the reservoir. Attempts to isolate *B. coli* from all samples gave negative results. The water from the reservoir showed

about twice as many bacteria per cubic centimeter as the water from the middle of the stream and this coincides with other tropical experience. In the Dongola campaign it was found that while water collected close to the bank of the Nile produced cholera in those who drank it, that which was taken from midstream could be drunk with impunity. An outbreak comprising 37 cases of bacillary dysentery with 14 deaths occurred among the native population in July, 1928, and 30 cases in August. All of these cases were treated at the Camilla Simpson Hospital in Olongapo.

It has been recommended that the water main be extended to the middle of the stream and that a large reservoir be constructed below

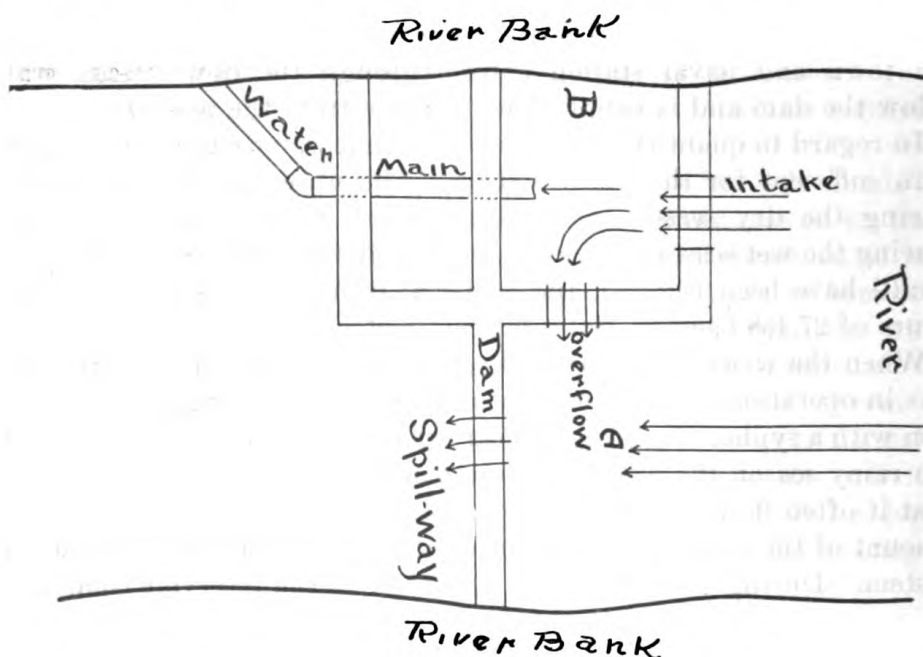


FIGURE 1

the dam and high enough so that the stream will not overflow into it during the rainy season. The water should be treated by coagulation and filtration before entering the distributing system with immediate subsequent chlorination preferably by chlorine gas in the pipe line. The other alternatives are the installation of a modern chlorination apparatus supplying chlorine gas to the water main, or the construction of deep or artesian wells. Until this is done it will be necessary to continue the use of distilled or boiled water for drinking purposes. The personnel of all ships are notified upon arrival to drink only distilled or boiled water.

The following precautions have been taken to stop the epidemic:

1. A letter addressed to the people telling them of the dangers of dysentery and how it is spread, with special emphasis on the follow-

ing points, was distributed throughout the reservation :

- (a) Cleanliness in handling food.
- (b) Reporting all cases of dysentery.
- (c) Killing flies and keeping flies from food.
- (d) Sunlight kills germs; therefore place bedding, etc., outdoors for airing.
- (e) Have children play outdoors in the sunshine.
- (f) Use distilled or boiled water for drinking purposes.
- (g) Cleanliness of hands.
- (h) Personal hygiene.

This notice was translated into the Tagalog language and 1,000 copies distributed through the schools and placed on bulletin boards.

2. Three civilian workmen have been detailed to cleaning and disinfecting the public toilets.

3. The families in which cases developed have been vaccinated with dysentery vaccine.

4. Two of the sewers from the public toilets have been lowered, and now are below water at low tide.

5. All cases were taken to the hospital as soon as detected.

6. Two of the three corps men on duty at the dispensary and one nurse from the town hospital were detailed to make a house to house canvas looking for dysentery cases.

7. An order has been issued directing the people to report immediately any case of diarrhea or dysentery to the reservation medical officer at the Camilla Simpson Hospital, Olongapo.

8. The marines detailed as patrolmen have been instructed to keep people off the beach near open sewers and to report any case of sickness discovered.

DISHWASHING AND STERILIZING EQUIPMENT ON BOARD THE U. S. S. SARATOGA

By **F. L. McDANIEL**, Lieutenant Commander, Medical Corps, United States Navy, and
J. L. Ross, Chief Pharmacist's Mate, United States Navy

Probably the most infectious period for communicable diseases transmissible by oral and nasal discharges is during the early stages before the disease is recognized and before the patient is isolated and placed under appropriate treatment. Among these diseases may be mentioned measles, mumps, scarlet fever, diphtheria, cerebrospinal fever, influenza, pneumonia, and the common infectious diseases of the respiratory type, which include acute catarrhal fever, tonsillitis, bronchitis, and Vincent's angina.

The measures for the prevention of catarrhal fever or "common colds" may be applied to the prevention of the other diseases in this

group spread by means of the secretions from the mouth and nose. These consist essentially in avoiding the infecting agent, and guarding against the predisposing causes.

It has been shown that colds are contracted from pre-existing cases in much the same manner as are measles, mumps, and scarlet fever. Rosenau states that Arctic explorers exposed to all the conditions ordinarily supposed to produce colds do not suffer from these ailments until they return to civilization and become reinfected by contact with their fellowmen. Also, carriers doubtless play an important part in disseminating colds as well as diphtheria, cerebrospinal fever, and, probably, acute anterior poliomyelitis which have a higher mortality rate.

The United States Public Health Reports state that observations conducted among employees of the Edison Electric Illuminating Co. of Boston during the 10-year period 1914 to 1924 showed the following:

(a) That 54 per cent of the absences on account of sickness among men lasting one day or more were due to respiratory diseases.

(b) That 71 per cent of these sick days were caused by the common cold.

(c) That colds disabled four out of ten men for 3.4 days annually. Townsend studied the prevalence of colds in Boston, Washington, New Orleans, Chicago, and San Francisco, widely separated localities, and reported that in spite of differences in climate there is a remarkable similarity in occurrences of respiratory affections throughout the country. The Annual Report of the Surgeon General of the Navy for the year 1926 states that when influenza and other acute infections of the respiratory tract are prevalent in an organization, one or more cases of cerebrospinal fever not infrequently develop. Various epidemiological factors probably result in there being increased numbers of meningococci carriers at large in different centers of population at or about the time when epidemics of influenza or common colds are occurring. The biological reactions between the meningococcus and the members of an exposed population group are such that direct spread of infection from one focus of the disease to another seldom occurs, and unless sanitary and hygienic conditions are very adverse comparatively few persons develop meningitis, though many are effectively exposed.

The predisposing causes of colds include a number of factors that depress vitality and diminish bodily resistance. Lowered resistance may be caused by conditions such as fatigue, loss of sleep, improper diet, exposure to wet and cold, excesses, over or underheating, deficient ventilation, dust, poor elimination, mechanical or pathological defects of the upper respiratory passages, and focal infections.

Under or over heating is an important environmental factor in the production of colds. The remarkable studies of the New York Commission on Ventilation, extending over a long period of time, show that an increase of 2° F. above the correct normal room temperature brought about a 70 per cent increase in ailments of the nose and throat. They also found that in a room at 75° F. people did 15 per cent less work than in a room at 68° F. The latter temperature is considered by most authorities as the ideal. Blasts of hot or cold air at high velocities should be avoided and care taken that men are not billeted in the vicinity of supply louvers where they must sleep in a current of hot dry air. Exercise or work in the open air is desirable and when indulged in tends to reduce the number of infections, not only by lessening the dangers through personal contact, droplet infection, and dust but also by the stimulating effect of the fresh cold outside air.

In addition to breathing vitiated and dusty air, one of the important predisposing factors to colds is overcrowding. Fine spray and droplets from the nose and mouth are disseminated in the air through talking, laughing, sneezing, and coughing, when many persons are occupying the same space and favor the propagation of communicable diseases. This was well illustrated in the crowded conditions on board transports during the World War. Many cases of these diseases developed among troops on board during the trips to Europe but tended to become less numerous after they were disembarked and began living under less crowded though not entirely favorable conditions ashore. Also acute respiratory diseases were of comparatively rare occurrence among troops exposed in the open to all varieties of weather conditions in the battle areas.

In this connection Rosenau states that crowding, especially of the kind that favors the spread of the buccal flora from mouth to mouth, must be discouraged. "Persons who sleep, work, and play together, wash from the same bowl and eat with the same tableware have every opportunity of spreading infections of the upper respiratory tract. This is why acute infections of the mucous membrane of the upper respiratory tract are common and often epidemic in camps, schools, prisons, institutions, ships, and industrial establishments. The factor of crowding and close personal contact needs emphasis and attention.

"Colds, like other diseases conveyed in the secretions from the nose and mouth, are often transferred by direct and indirect contact through lack of hygienic cleanliness and a disregard of sanitary habits."

The common drinking cup—which is now seldom encountered on board naval vessels except perhaps in some wardrooms—mess gear,

pipes, cigarettes, mouth-operated musical instruments, pencils, fingers, and other objects contaminated with the fresh secretions will often transmit the disease.

Gatewood states that every effort should be made in the routine care of a ship to prevent the fluids of the mouth of one man from gaining access to the body of another. "With that end in view, all mess gear and dishcloths after each meal should be subjected by machine or otherwise to hot water, spitkids containing water should be in place, every man should be required to be at the spitkid when he expectorates, and spitting on any deck day or night should be punished."

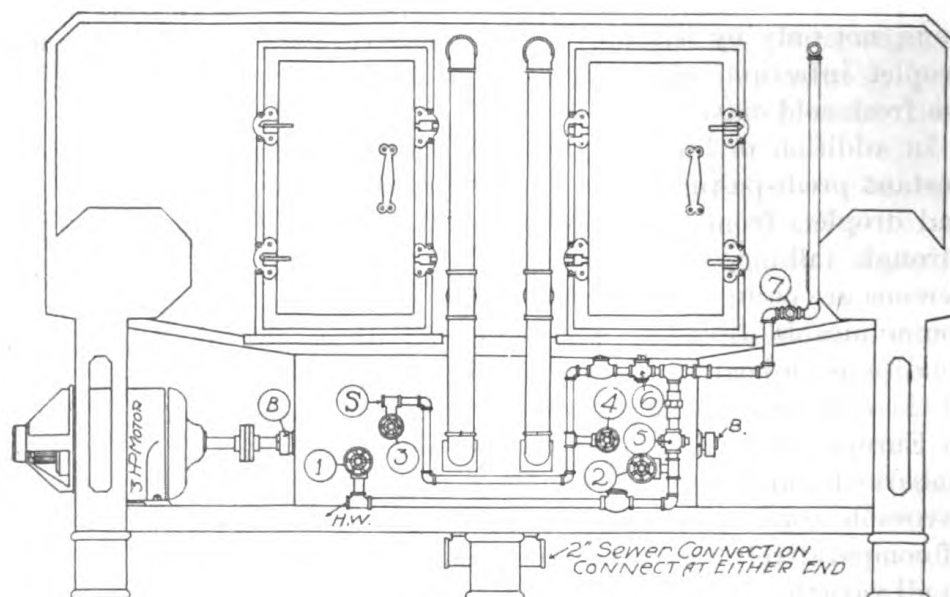


FIGURE 1

Sterilization of mess gear is one of the practicable methods for limiting the direct or indirect transference of mouth and nose secretions and should be carefully performed and supervised at all times on board naval vessels and at shore stations.

It has been noted that when outbreaks of acute colds, influenza, mumps, and other diseases which are spread in a similar manner, occur on board ship, a careful observation of the actual routine of the sterilization of mess gear will often reveal defects in the method of procedure even though the equipment itself is capable of efficient sterilization. This may happen because of the inexperience or inefficiency of the operator. Among other factors are failure to maintain the water in the sterilizing tank at 212° F., due to the lack of a thermometer or on account of the heat during hot weather, and insufficient exposure of the dishes to boiling water in the tank. For efficient results all mess gear should be completely submerged in boiling water, 212° F., for at least one minute.

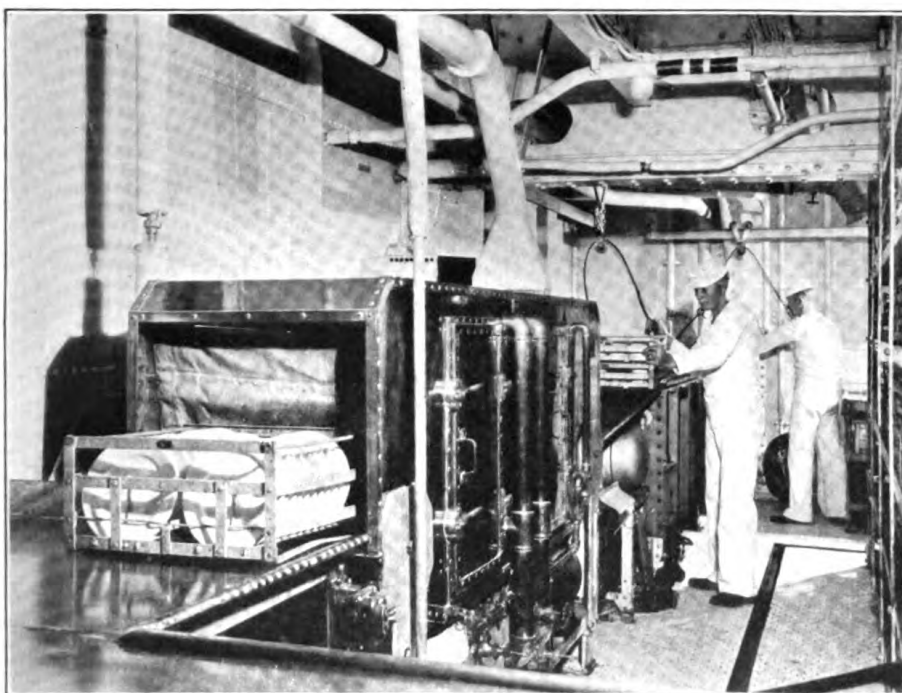


FIG. 2.—DISHWASHING MACHINE ON U. S. S. "SARATOGA." WASHING AND RINSING



FIG. 3.—DISHWASHING MACHINE ON U. S. S. "SARATOGA." STERILIZING TANK

The equipment installed on board the U. S. S. *Saratoga* for the washing and sterilization of mess gear consists of two distinct devices—one, a machine of the spray type, in which the mess gear is washed and rinsed (figs. 1 and 2), and the other a tank (fig. 3), in which the sterilizing process is accomplished. It should be noted that these two functions coexist to some extent in both processes. The diagram (fig. 1) shows a left-hand-feed machine; the right hand is arranged exactly opposite. This type of machine is installed on both the U. S. S. *Saratoga* and the U. S. S. *Lexington*.

It consists of an inclosed metal hood of nickel-copper alloy provided with curtains at each end and exhaust openings in the hood. Easily removable strainers of an approved nickel-copper alloy are provided for holding insoluble matter washed from the dishes. The hood is arranged so as to reduce to a minimum the mixing of wash and rinse water. Two tanks are located in the base of the machine, one for a solution of soap or a soap compound in hot water for washing, and the other for hot clear water for rinsing purposes. The water for washing and rinsing is pumped upon the dishes from above and below in heavy sprays by circulating the water from the respective tanks.

Steam as well as water connections are fitted in both tanks of sufficient capacity to maintain a temperature of about 120° F. in the wash water, and about 200° F. in the rinse water. Readily visible thermometers are installed to measure the temperature of the water in each tank and overflow pipes 10 inches long at the surface of the water are provided to remove scum and grease. The water is forced through the jets or sprays by a 3-horsepower electric motor, the shaft of which extends through a stuffing box in the side of the tank and is connected with pumps located within. This type of construction does not apply to other makes of machines which have the pump located outside of the tank. A final spray is placed so as to discharge clear hot water upon the dishes just before they leave the machine. The dishes are handled in metal racks or baskets which are propelled through the machine manually on a metal track made of nickel-copper alloy. The specifications require that the machine shall not require more than 70 gallons of initial water and that the total water and steam required for the first hour of operation shall not exceed 1,500 pounds or 180 gallons. Also, that the machine shall have a washing capacity of at least 240 basket sections of ordinary soiled dishes per hour and shall wash egg-soiled dishes satisfactorily. A drain or sewer connection is fitted to both the wash-water and rinse-water tanks. The machines are designed so that all parts are accessible and may be easily and thoroughly cleaned.

Adjustments for operation consist in opening the final spray control valve (7) by pressing the lever down level with the track. The valve (5) of the water supply to the final spray is opened until water is sprayed from the bottom pipe to about 10 inches above the track on which the racks move. The valve (6) of the steam line to the final spray is opened enough to supply sufficient steam to maintain the temperature of the final rinse water at 180° F. After these adjustments have been made they need not be changed until the process is completed.

To operate the machine both overflow standpipes, which also act as waste outlets, are set properly into their sockets in the bottom of the tanks on the inside. Both tanks are then filled with water by opening valves No. 1 and No. 2, and the water heated by allowing steam to flow through valves No. 3 and No. 4. Two cupfuls of washing powder are added to the water in the wash-water tank. The motor is then started and allowed to run for a few minutes before starting the dishes through the machine. The dishes are scraped at the mess tables and placed in aluminum baskets, using appropriately fitted baskets for plates, bowls, cups, and glassware. Silverware is placed in another container and sterilized by live steam in a separate tank. These baskets are then taken by the messmen and stacked outside the scullery window. The scullery men then pass them under the curtain at the left end. As each basket enters it forces the basket previously placed into the machine along the roller track so that the dishes come in contact with the wash water, rinse water, and final rinse water in the order named, and leave the machine thoroughly clean. The spray pipes and removal screens are cleaned each time after all the dishes are washed. A special brush called a "clean-out" brush is supplied for cleaning the spray pipes. When the baskets emerge from the right end of the dishwashing machine they are picked up with tongs, manipulated by a wire rope which passes through a pulley secured to an overhead track, and lowered into the sterilizing tank.

The sterilizing tank, 9 feet 8 inches long and 2 feet wide (inside measurement), is placed adjacent to the right end of the dishwashing machine and connected with it by a steel shelf. This tank is made of nickel-copper alloy and accommodates 6 dish containers or baskets, 17 inches in length, 21 inches in width, and 11 inches in height submerged 2 inches below the surface of the water. It is equipped with a link-belt metal conveyor which travels at a maximum speed of 8 feet per minute and is operated by a variable-speed motor of about 1 horsepower. The conveyor throughout its length is sufficiently rigid to support six baskets with dishes. It is driven by sprockets on a shaft extending through bearings and stuffing gland in the back of the tank. The entire conveyor system may be removed

from the tank to permit access for cleaning. Steam is supplied through a brass pipe tested to 100 pounds hydrostatic pressure per square inch and perforated throughout its entire length so as to admit steam direct to the water. It is placed along one side of the conveyor and is of sufficient size to maintain the water and 360 pounds of baskets and dishes per minute at a temperature of at least 200° F. The motor is of a water-tight type suitable for operation on a 230-volt direct current circuit. It is equipped with a splash-proof, quick break, fused starting switch and a splash-proof field rheostat for speed control.

Reduction gears completely inclosed and packed with grease connect the motor with the shaft. A water drain and valve is provided at the bottom of the sterilizing tank. An opening 18 inches in length in the end plate of the tank distal to the washing machine for removing scum and overflow water is also connected to the drain. A temperature indicator of rugged construction, all connections, and valves are mounted on the front of the tank. The conveyor framing, chain and all sprockets, shafts, and other appliances within the tank are made of noncorrodible metal.

Criticism.—The dish-washing machine is practical, efficient, and almost foolproof. It is necessary that dishes be thoroughly scraped of food particles in order to obtain the best results. Unless cups are properly stacked in the containers, the spray may not reach and thoroughly clean the bottoms of the cups.

The sterilizing tank is arranged so as to give dishes at least a full minute exposure to boiling water and live steam. As dishes have been previously exposed in the dish-washing machine to hot soap spray and boiling water spray, the second apparatus insures efficient sterilization. Tests are made weekly of the sterilization efficiency and all cultures from dishes passing through the two devices have been negative for bacterial growth.

EDITOR'S NOTE.—Sterilization of mess gear is undoubtedly an important factor in the control of communicable diseases spread by means of secretions of the nose and mouth. Continued prevalence of colds, influenza, measles, and mumps should lead medical officers to suspect that sterilization is not being properly performed. Transfer of infective material from one person to another may occur through the use in comparatively inaccessible places, such as fire-rooms, turrets, etc., of buckets, tin cans, and other small water containers which are frequently substituted for the common drinking cup. A small outbreak of acute colds occurred on board the U. S. S. *Mississippi* during the spring of 1927, while cruising in the Tropics under weather conditions that did not seem conducive to the spread of the disease. The temperature on board ship was high and water was being consumed in large quantities. Investigation showed that

all mess gear was being efficiently sterilized in the scullery. This procedure was nullified to some extent by the practice, originated by men working in places distant from the scuttle butt, of filling cans with water and carrying them to the spaces where they were at work. In drinking the water, the containers were passed from mouth to mouth. It was not possible at the time to confiscate the cans and stop the practice; therefore, other measures to control the spread of infection had to be devised. Steam lines that could be easily tapped were located contiguous to each of the two scuttle butts. Two new galvanized-iron cans with close-fitting covers were secured and installed with a steam pipe extending through a small opening in the cover to within 2 inches of the bottom. The cover could be raised from the top of the can, but because of the steam pipe perforating it could not be removed. A sentry was posted at each scuttle butt to indoctrinate the men in the purpose of the cans. Each water container was placed in the can and scalded with live steam before being filled. While this procedure was not ideal, it was the best that could be devised at the time and at least assured the periodic disinfection of all drinking cans. The outbreak of acute colds promptly subsided.

**EXPERIENCE WITH CEREBROSPINAL FEVER AT THE UNITED STATES
NAVAL TRAINING STATION, NEWPORT, R. I.**

By R. J. STRATTON, Commander, Medical Corps, United States Navy, and G. A. ALDEN,
Lieutenant Commander, Medical Corps, United States Navy

Within the 3-year period 1926 to 1928 there were three small outbreaks of cerebrospinal fever at the United States Naval Training Station, Newport, R. I. The first outbreak began August 8, 1926, with the appearance of one case. Another case developed on August 11 and two on August 15, after which no more were discovered until October 12, when a fatal case occurred, making five cases in all. An apprentice seaman, however, who had been transferred to the U. S. S. *Concord* September 11, and who showed symptoms of cerebrospinal fever when he arrived on board, really contracted the disease at the training station.

The first case of the second outbreak appeared on January 24, 1928, and the remaining four on February 2, 18, 23, and 24, respectively. From the first of January there was a steady rise in the number of admissions for catarrhal fever, acute. This rise continued until the latter part of February, then a gradual decline ensued, reaching the average admission rate about the middle of March.

Only two of the five cases, the first and the last, had definite objective findings when transferred to the hospital. The other three cases were diagnosed after meningococci had been identified in smears from the cerebrospinal fluid made at the hospital.

None of the five cases had been in contact with one another. They came from different companies and had completed the detention period of 21 days. One man had been in detention the required three weeks but had not been transferred from the detention unit. Three men had been on liberty two or three times and one had just returned from 10 days leave and been placed at once on special detail where he was not in contact with any other recruits. All contacts were isolated for a period of 10 days under close medical supervision. No case developed among those isolated.

An abstract of the subjective and objective symptoms, with treatment and results follows:

CASE 1.—P. H., admitted at 7 a. m. January 24, manifesting the typical signs and symptoms of cerebrospinal fever. His white blood count was 28,000. On arrival at the United States Naval Hospital, Newport, R. I., a short time later, his count was 31,000 with 95 per cent polymorphonuclears. Spinal fluid under pressure and cloudy; meningococci present. During the course of the acute stage he was given a total of 120 cubic centimeters of antimeningococcic serum intraspinally. Patient has made an uneventful recovery.

CASE 2.—K. G. A. reported at the dispensary on February 2, 1928, complaining of a cold, sore throat, and general malaise, temperature 100° F., with the usual objective findings of an ordinary case of catarrhal fever. White blood count, 6,400. At 4 p. m. his temperature was normal and remained normal until midnight, when he had a slight chill with a sudden rise of temperature to 105° F. A few hours later he was transferred to hospital manifesting no symptoms of meningeal irritation and feeling fine except for the high fever. Upon arrival at the hospital the white blood count was 19,000 with 92 per cent polymorphonuclears, and in view of the fact that a case of cerebrospinal fever had been received from this station a spinal puncture was made. The fluid was cloudy and under slightly increased pressure, fluid positive for meningococci. During the course of the disease he was given 120 cubic centimeters of antimeningococcic serum intraspinally. There was a marked serum reaction at each injection. Patient developed an acute arthritis of right knee and ankle, which is slowly improving.

CASE 3.—H. R. reported at the dispensary at 10 p. m. on February 18 complaining of slight headache, chills, and general malaise. He states that he had felt chilly for the last two days and had spent most of his time during this period in the drying room trying to keep warm. His temperature was 105° F. White blood count, 48,500. There were no objective symptoms of meningitis. The following morning his temperature had dropped to 102° F. with no change in his condition. Upon arrival at the hospital his blood count was 10,800 with 67 per cent polymorphonuclears. Spinal fluid was found to be under pressure, cloudy, and positive for meningococcus. He was given a total of 165 cubic centimeters of serum. Arthritis of the left knee developed, but he recovered and was discharged to duty May 4.

CASE 4.—T. C. A. reported at sick call on February 23, 1928, at 7 p. m. with a temperature of 104° F. and complaining of not feeling well for two days and of having slight chills during the afternoon. His chief complaints were a cough, slight headache, and moderately sore throat. Physical findings negative, except inflamed pharynx and occasional moist râle posterior. White blood count, 11,000. He was placed on the sick list with a diagnosis of catarrhal fever, acute. The following morning temperature 103° F. with no change in symptoms

or anything suggesting meningitis. Patient was transferred to the hospital as an ordinary case. A 4 p. m. white blood count was 22,750 with 85 per cent polymorphonuclears. Spinal fluid positive for meningococci. He was given a total of 190 cubic centimeters of antimeningococcic serum intraspinally and has fully recovered.

CASE 5.—L. H. J. admitted to the sick list at 1 p. m. on February 24 with a temperature of 102° F. and with symptoms and findings of catarrhal fever, acute. During the night the temperature gradually rose to 104° F., and he passed into a state of marked restlessness, muttering delirium, positive Kernig, and rigidity. At time of transfer his temperature had dropped to 100° F.; white blood count 30,000, with 92 per cent polymorphonuclears. Spinal fluid positive for meningococci. He was given a total of 120 cubic centimeters of serum intraspinally and made an uneventful recovery.

In the foregoing cases of cerebrospinal fever there was a definite relation between the increase of admissions of catarrhal fever, acute, and appearance of cerebrospinal fever. It appears from these cases that one should be on the lookout for meningitis under such conditions, especially with a sudden rise of temperature and an increased white blood cell count. A low-blood count does not rule out the presence of developing meningitis. After the positive physical findings appeared there was a definite leukocytosis of twenty thousand or more. One is warranted in making a spinal puncture when there is a high temperature preceded by chills, in which there are no physical findings to account for it, in the presence of a catarrhal-fever epidemic, regardless of the amount of leukocytosis.

These few cases show the value of early administration of serum, and therefore every effort should be made to make a diagnosis, resorting to spinal puncture and not waiting until definite symptoms develop.

The sporadic case which occurred on April 28 was that of a musician, second class. During the afternoon he was carried into the sick bay from his quarters on the station. He had not been feeling well during the preceding two days, had continued with his work, and had not reported at sick call. Cerebrospinal fever was suspected, and he was immediately transferred to the naval hospital, Newport, R. I. The symptoms noted there were as follows: "Wildly delirious; marked retraction of neck; Kernig's and Brudzinski's signs present." Spinal fluid withdrawn; marked pressure and cloudy. Smear and culture positive for meningococcus. The white blood count was 18,400, and the differential count showed 84 per cent polymorphonuclear leukocytes and 16 per cent lymphocytes. Urine was normal. The diagnosis was established as cerebrospinal fever the same day.

This man had not been in contact with any known case of cerebrospinal fever. He was a member of the "ship's company," was allowed daily liberty, and did not come into close contact with recruits.

He received 180 cubic centimeters Flexner's serum, given 30 cubic centimeters daily for six days. No complications developed, and he was discharged to duty on July 3.

Another sporadic case occurred on August 9, 1928. An apprentice seaman of the Navy, who had been granted leave of absence and left the naval training station on August 3, became ill while in New York City and was admitted to the naval hospital at that place on August 9. He had been granted liberty while at this station, but there were no known cases of cerebrospinal fever in the vicinity at the time.

The third outbreak began on September 4, when a recruit with about one month's service developed a sore throat and was transferred to hospital. The following day meningococci were demonstrated in the cerebrospinal fluid. Other single cases appeared September 5 and September 8. In the second case the patient had vomited a short time before he reported for treatment when a slight macular eruption on the abdomen, some rigidity of the neck, and a white blood cell count of 26,000 were noted. He was transferred to hospital, where the diagnosis was confirmed the same day. In the third and last case the patient stated that he had a headache and slightly sore throat, but he presented symptoms of toxemia not warranted by the objective signs in his throat. He was transferred to hospital the same day, where meningococci were found in the cerebrospinal fluid.

In three cases the patients became ill at times sufficiently separated from the actual outbreaks to cause it to be believed they were not responsible for further dissemination of the infective microorganisms.

The distribution varied somewhat, but while most of the men were taken ill during the fourth or fifth week of training, only one case occurred in the "finished-training" detachment, and one case in the ship's company.

The clinical symptoms were headache and general malaise, moderate fever and chilliness, with a mild pharyngitis. In all but one case a high white blood cell count was found, which varied from 11,000 to 48,000 per cubic millimeter with over 90 per cent polymorphonuclear leukocytes. One patient who had a normal white blood cell count in the morning developed a count of 18,000 during the middle of the afternoon after he was removed to the hospital. He had been transferred prior to the reaction of the protective forces of the body to the early meningococcic septicemia.

The patients in all but one of the cases treated at the United States naval hospital, Newport, R. I., recovered and were subsequently returned to duty. The fatal case was that of a seaman, second class, who had completed the training period about three months previ-

ously. He was attacked October 12, 1926, while detailed in the commissary, where he had little contact with persons outside that department. Undernourishment and excessive indulgence in alcoholic liquor three days before meningitis developed were regarded as predisposing influences. He was not transferred to hospital until about 24 hours after the illness began. Upon admission to hospital he was delirious and difficult to control. He died the following evening. Two doses of antimeningococcus serum were administered intraspinally eight hours apart.

The methods employed to check the spread of the disease were immediate segregation of the company in which a case occurred, quarantine of known contacts, and disinfection of the decks by thorough scrubbing. It may be stated that properly supervised sterilization of mess gear and cleanliness in the mess halls by daily washing with fresh water and once a week with a lysol solution are regularly practiced at this station.

In the first outbreak three cases developed in one company and it was only after the last case appeared that spraying of the nose and pharynx of all members of the company was started. During the second outbreak the nose and throat of all members of the company in which a case of cerebrospinal fever occurred were sprayed twice a day with 10 per cent argyrol solution. Following this no secondary cases developed in any company in which this procedure was practiced. When, however, cases continued to appear in different companies it was decided to spray the nose and throat of every person in the entire training unit, including the new arrivals. No other case then occurred until two months later, when a sporadic case developed. The patient was a bandsman who had not received this treatment.

The last outbreak was confined to two companies. Two cases occurred within a day of each other among the members of one company and the third case in another company one week later. The measures outlined above, including the argyrol spray, were immediately placed in effect and apparently controlled the outbreak.

No factors common to all cases could be elicited in the spread of infection in the first and third outbreaks. During the second outbreak it was learned that competitive mouth-organ playing was extensively practiced by the recruits and, because of the lack of instruments, those available were passed around to many members of the same company. In this connection it is interesting to note that the first patient attacked by cerebrospinal fever was one of the best players and had probably infected the instruments he used, which were then passed to other persons in his company.

While the dissemination of virulent meningococci is the essential cause of enough cases of cerebrospinal fever to justify using the term

"outbreak," susceptibility on the part of the individual seems to play the more important part. The questionnaire submitted by the Bureau of Medicine and Surgery and which requires a statement of all ascertainable evidence contributory to susceptibility in every case of cerebrospinal fever, such as overcrowding, defective ventilation, overheating, fatigue, exposure to chilling, wet clothing, predisposing infection, or any other factor deemed worthy of mention was carefully considered in each individual case. No predisposing cause in common, however, could be elicited except that of fatigue due to overexertion.

The method of training required exhaustive drills in the manual of arms and the rifle was given to the recruit at the end of the first week. These drills were the most severe during the detention period, the first three weeks after the company was formed. When they reported many recruits were undernourished. The wholesome food provided at the training station could not correct this condition for at least three or four weeks, and in the meantime they were undergoing the most strenuous existence of their young careers. They were placed in a new environment and under the strictest discipline. Exhaustion and lowering of resistance were naturally bound to follow. It is believed that this goes far in explaining the preponderance of cases during the fourth and fifth weeks.

After the last outbreak these observations were submitted to the commanding officer, Capt. T. L. Johnson, United States Navy, who, upon the recommendation of the medical officer, ordered such changes in the method of instruction that would correct the burdening of the recruit so soon after his arrival. Rifle drills were very much reduced during the detention period and less arduous drills and exercises substituted. It will be of interest to note what changes this will cause in the incidence of cerebrospinal fever at this station in the future.

REPORT OF A CASE OF CEREBROSPINAL FEVER WHICH DEVELOPED ON BOARD THE U. S. S. "PAUL HAMILTON"

By E. L. WHITEHEAD, Lieutenant Commander, Medical Corps, United States Navy

The patient, an apprentice seaman of the Navy, was received on board the U. S. S. *Paul Hamilton* on July 30, 1928, with a draft of recruits and was apparently in perfect health at the time. The *Paul Hamilton* belongs to the Thirty-second Destroyer Division and was in Port Angeles, Wash., moored alongside the U. S. S. *Melville*, together with four ships of the Thirtieth Destroyer Division undergoing tender overhaul. The remainder of the Thirty-second Division, including the ship with the medical officer of that division, was at Seattle, Wash.

About 5.30 a. m., August 1, the writer was called to the *Paul Hamilton* by the chief pharmacist's mate attached to the ship to see a patient and was told that he had awakened a few minutes before, and walked unsteadily to the end of the compartment where he had fallen in a "fit." On examination he was semiconscious, breathing heavily, and showed minor abrasions. The eyes were somewhat dilated, he had vomited, and his clothes were wet with urine. The description of the "fit" as given by eyewitnesses was very suggestive of an epileptic attack. He was made comfortable in his bunk temporarily, pending transfer to the U. S. S. *Melville*, and kept under observation. About an hour later he had another similar attack with vomiting, incontinence of urine, and unconsciousness, but no definite meningeal symptoms were noted. At 10 a. m. he was transferred to the U. S. S. *Melville*, where he had another attack or convulsion with tonic and clonic spasms without regaining consciousness. As possible diagnoses, status epilepticus, hysteria, lethargic encephalitis, and meningitis were considered. His white blood count was 25,000, with 98 per cent polymorphonuclear leukocytes. Spinal puncture was performed by the senior medical officer three hours later. The cerebrospinal fluid was found to be under great pressure and turbid. Thirty-five mls were withdrawn and 30 mls of antimeningococcus serum injected. Microscopic examination of the fluid, which showed gram negative intracellular diplococci, established the diagnosis as cerebrospinal fever.

Considerable improvement was noted following the relief of pressure by spinal puncture. Definite clinical signs of cerebrospinal fever also appeared, including stiffness of the neck, Kernig's sign, and a rather profuse typical rash. Spinal puncture was repeated at 9 a. m. August 2, when 30 mls of antimeningococcus serum were given intraspinally and 15 mls intravenously. Considerable alleviation of symptoms again followed the puncture and the patient became conscious and rational at 10 a. m. At this time he was transferred to the U. S. S. *Kennedy* for transportation to the naval hospital, Bremerton, Wash. During the trip his mental condition improved greatly. He took nourishment for the first time, and after one-eighth grain of morphine by mouth, he rested comfortably on the 4-hour trip, although sleeping on deck next the blowers, which were running at full speed. At no time during his illness did he complain of headaches or show the usual hyperesthesia or sensitiveness to light and sound.

After admission to the naval hospital on the same day, another spinal puncture was performed and antimeningococcus serum injected. Since then, no other spinal punctures were done and he received no more serum. Upon visiting him five days later he was

practically free of symptoms except for some deafness which had appeared three days previously and was then improving.

Clinically, the most interesting feature was the fact that this case which at first appeared to be one of the severe fulminating type and in which a poor or guarded prognosis is usually accorded, showed immediate and apparently lasting improvement when vigorous treatment with antimeningococcus serum was started within seven hours after mental symptoms became evident.

Investigation showed the patient to have been one of a draft of 147 men which left the naval training station, Great Lakes, Ill., on July 25, and was transported to Seattle, Wash., by train. Upon arrival, about 100 men of the draft were assigned to the navy yard, Bremerton, Wash., and to various ships of the Battle Fleet then at anchor near Seattle, and the remaining 47 men to destroyers. Fourteen of the men from the draft were transferred by ferry and train to Port Angeles, Wash., where six were detailed to a ship of the twelfth destroyer squadron then moored alongside the U.S.S. *Altair* and eight to the *Paul Hamilton*. The seven men remaining under my observation on the latter vessel after the case of cerebrospinal fever had been transferred to hospital were segregated on the forecastle of that ship. The eleventh squadron commander, then on the U.S.S. *Decatur*, which was at Seattle, and also the commander, destroyer squadrons, Battle Fleet, was informed by radio of the case, and it was recommended that all members of the draft which had been received by him be traced and segregated under medical observation. The draft on the *Paul Hamilton* was sent to the *Melville*, about 35 other members to the U.S.S. *Relief* in Seattle, and about 15 to the naval hospital, Bremerton, Wash. No information is at hand as to action taken by the battleships. No quarantine was established on any of the ships.

No other members of the draft developed symptoms of the disease, nor were any carriers found, so far as I know, following throat cultures.

**A CASE OF CEREBROSPINAL FEVER AT THE UNITED STATES NAVAL
TRAINING STATION, SAN DIEGO, CALIF.**

The following is based upon the report by Capt. J. B. Kaufman, Medical Corps, United States Navy, of a case of cerebrospinal fever which occurred at the United States naval training station, San Diego, Calif., on April 29, 1928.

The patient, a radio man, third class, who had been serving on board the U. S. S. *Colorado* was detached from that vessel at San Francisco, Calif., and took passage on board the U. S. S. *Neches* from that port to San Pedro, Calif., completing the trip to San Diego, Calif., by bus and arriving at the training station April 14.

The records show that the day he arrived on the station he reported at sick call because of a slight cold for which he was given treatment. He did not return, as directed. He performed his duties at the Sound School, to which he had been detailed, and was quartered with other men in the upper south part of barracks C-4.

At 2 p. m. April 29, 1928, the dispensary received a telephone call from a yeoman, second class, quartered in the same barracks who stated that a man had been sick since noon, and that he had been trying to get him to report at the dispensary, but he would not come. The corps man on watch who answered the phone immediately responded to the call, found that the man was unable to walk, was in a semistuporous condition, and having an attack of vomiting. He at once sent for a stretcher and another corps man. With a commendable sense of judgment, these corps men, from previous experience, suspected meningitis, brought the patient to the dispensary, and placed him in a bed in one of the cubicles reserved for communicable diseases. He was immediately seen by the medical officer on watch, who found him stuporous. When aroused he talked rationally, but tended to fall asleep while the medical officer was conversing with him. A history was difficult to obtain, but he did state that he had been sick since 10.30 a. m. that date, had vomited, but thought he would recover without any treatment, and, furthermore, wanted to attend a funeral in San Diego that afternoon. He also stated that his chief complaint had been headache and that "it jarred his head to move." While on liberty the previous day he apparently had obtained some Bayer's aspirin tablets, or else had been given these by some shipmate, and had taken two of these in the forenoon of April 29. When examined by the medical officer of the day his temperature was 102.4° F., pulse 108, respiration 26, he was stuporous, pallid, neck muscles were stiff, and vomiting was projectile, Kernig's sign was positive, and a white blood cell count was 18,300, with 91 per cent polymorphonuclear leukocytes.

He was immediately transferred to hospital where the diagnosis was confirmed and he was given two intraspinal injections of anti-meningococcic serum, 30 cubic centimeters each, eight hours apart on the day of admission. Additional daily intraspinal injections of serum in the same amounts were administered during each of the six succeeding days. Two weeks later he was up and about the ward, felt well, and exhibited no residual symptoms. No complications developed and the patient was discharged to duty June 12.

A shipmate of the patient, who accompanied him to San Diego, stated that there were no known cases of cerebrospinal fever on board the U. S. S. *Colorado* when they were detached. While the ship was at the navy yard, Bremerton, Wash., in February, 1928, nine cases developed on board and the patients were transferred to the naval

hospital at that station. None of the cases occurred in the compartment in which this patient was billeted, but several men in the compartment directly adjacent had developed symptoms of the disease and were subsequently transferred to the hospital. Upon arrival at San Pedro, Calif., about February 11, the ship was placed in quarantine for six days.

An inspection of the barracks dormitory previously occupied by the patient showed 25 cots, and while normally this is well within the limits of dormitory accommodation, to avoid any possible overcrowding, half of the cots were moved to the dormitory below and this entire wing (upper and lower C-4 south) placed in quarantine. Bidaily inspections of the personnel occupying this unit were made and on May 1, 1928, plates were made of the contacts and delivered to the laboratory corps man sent from the naval hospital for this purpose. The result of this procedure showed that none of the 25 contacts were carriers.

The Department of Health of San Diego stated that while two cases of cerebrospinal meningitis were reported for the month of March, none were reported during April. The last case of cerebrospinal fever which occurred at the station was that of a recruit who had been transferred to the United States naval hospital, San Diego, on February 19, 1928, with a definite attack of acute appendicitis and developed the disease two days later.

AN EPIDEMIC OF INFLUENZA ON BOARD THE U. S. S. "LUDLOW"

An epidemic of mild type of influenza which was reported by Lieut. J. D. Jewell, Medical Corps, United States Navy, occurred between June 27 and July 13, 1928, on board the U. S. S. *Ludlow*, the flagship of Mine Squadron 2 at the United States naval station, Pearl Harbor, Hawaii.

Of the crew of 99 men, 22 were attacked as follows: June 27, 1; July 3, 3; July 4, 2; July 5, 8; July 6, 7; July 11, 1.

Malaise, which persisted for a day or two, was the first symptom experienced by those attacked. This was followed by chills, a rather sudden rise in body temperature (which varied from 99.5° F. to 103° F.), vertigo, moderate coryza, dryness of the throat, general muscular pains, especially in the lumbar region, moderate conjunctivitis, and a slight cough. Upon investigation it was learned that influenza was prevalent in Honolulu and vicinity and that one epidemic had been reported which occurred among the nurses at the principal civilian hospital.

Although epidemics of influenza usually terminate spontaneously in about three weeks, the following measures were thought to have had

a favorable effect upon the incidence of the disease and the course of the outbreak:

(a) All sick were immediately transferred to the naval hospital as soon as the illness was discovered.

(b) The crew of the *Ludlow* was not allowed to visit crews of other ships. The crews of other ships were not allowed to visit the *Ludlow*. There was no restriction of liberty.

(c) All dishes and dish towels were boiled after each meal.

(d) Mess men were inspected twice a day.

(e) As many men as could find sheltered places slept on deck, other men slept as far apart as possible.

(f) Naval reservists were not brought aboard until epidemic had abated.

Sinus and lung complications were fortunately negligible in number. The average duration of the disease, from five to six days in each case, suggests its mild character.

OUTBREAK OF CATARRHAL FEVER ON BOARD THE U. S. S. "CLEVELAND"

An outbreak of acute catarrhal fever on board the U. S. S. *Cleveland* began on August 1, 1928. G. E. Mott, lieutenant, Medical Corps, United States Navy, states that during a visit of the U. S. S. *Cleveland* to Honduran ports in July he was informed that a mild form of catarrhal fever or "common colds" was then epidemic in Honduras, but that no serious cases were recorded except a few sporadic cases of a mild type of broncho-pneumonia.

When the vessel arrived in Canal Zone waters on July 28 it was learned that some form of catarrhal fever was prevalent ashore and that many cases had occurred at the United States naval station, Coco Solo, Canal Zone. Up to this time no cases had developed on board the U. S. S. *Cleveland*.

The ship left Colon for the east coast of Nicaragua on July 30, and the following day the first admission to the sick list for an acute infection of the upper respiratory tract was recorded. Subsequently about 20 per cent of the crew were affected with this catarrhal condition within a period of about six weeks. Twenty-one developed symptoms sufficiently severe to require admission to the sick list and about 40 others who presented symptoms of a milder type were also treated. Of the cases admitted to the sick list 18 occurred in August and 3 in September, the peak apparently being reached about August 15.

In practically all cases the attack began with a chill followed by fever. Those admitted to the sick list had a temperature of about 102° F., coryza, and cough, together with great prostration. There were no complications and all patients recovered in about three days.

No case was transferred to a hospital. No sequelæ were observed except weakness, which persisted for several days. During the outbreak the weather conditions were excellent. Bedding was aired daily and the crew encouraged to remain on deck in the sun and open air. On October 1 there had been no admission for this disease since September 20, and the medical officer felt that the outbreak had been controlled.

White blood cell counts were apparently not made, but the sudden onset and great prostration suggest that the disease was influenza of a mild type.

AN EPIDEMIOLOGICAL AND STATISTICAL STUDY OF TONSILLITIS, INCLUDING RELATED THROAT CONDITIONS¹

In view of the widespread attention which has been given in recent years to tonsil defects and their remedy by tonsillectomy, it was deemed worthwhile for the Public Health Service to make a study of acute and chronic diseases of the tonsils and throat. The results of this study are given in a Public Health Bulletin No. 175, recently issued.

The data used consist of: (a) Records of sickness occurring in several groups of people kept under observation for illness for several years; and (b) results of physical examinations made by medical officers of the United States Public Health Service in the course of various field studies conducted during the past 10 years. The bulletin considers acute tonsillitis and sore throat, enlarged and diseased tonsils as found on physical examination, and the relation of the condition of the tonsils to illness and to physical defects. Mortality from diseases of the tonsils and pharynx is also briefly considered.

Some of the outstanding results may be briefly summarized:

The incidence of tonsillitis and related conditions of the pharynx is higher among children of school ages than before or after those ages. Laryngitis, on the other hand, appears to occur more frequently among adults than among preschool or school children. Tonsillitis and related conditions of the pharynx appear to be the only important respiratory affections which show this particular age incidence; that is, higher during the school ages than among younger or older persons.

The incidence of tonsillitis and related conditions of the pharynx appears to be considerably higher for females than for males.

The relative age incidence of acute tonsillitis and sore throat is strikingly similar to the relative age prevalence of diseased tonsils as found on physical examination. The relative prevalence of en-

¹ Reprinted from *HEALTH NEWS* 2-6, March 1, 1928, published by the United States Public Health Service.

larged tonsils as found on physical examination is also similar to the relative age incidence of acute tonsillitis and sore throat, but does not show as close correspondence as the curve for diseased tonsils.

The prevalence of defective tonsils does not seem to be significantly greater in rural than in urban districts. Removal of the tonsils, however, was considerably more frequent in the urban groups examined than in the rural.

The prevalence of defective tonsils seems to vary somewhat with the season of the year, but the variation is less than the variation in the incidence of acute tonsillitis and sore throat. The maximum prevalence of defective tonsils appears to be reached about April, a period of two or three months after the maximum incidence of acute tonsillitis and sore throat and of colds.

The incidence of sore throat seems to be more than twice as great for school children with defective tonsils as for those whose tonsils have been removed. The incidence among children with normal tonsils also appears to be less than among those with defective tonsils.

Respiratory diseases other than tonsillitis appear to be somewhat more frequent among children with defective tonsils than among those with normal tonsils and those whose tonsils have been removed. Among adults there seems to be little difference in the incidence of these respiratory diseases in the different tonsil groups.

The incidence of illness from rheumatism and related conditions appears to be higher among adults who have attacks of tonsillitis than among those who are free from tonsillitis.

The incidence of diphtheria among children with defective tonsils seems to be much higher than among tonsillectomized children. Among children with normal tonsils it appears to be only slightly higher than among those whose tonsils have been removed.

The results of the physical examination suggest that adenoids, enlarged cervical glands, conjunctivitis, eye strain, and decayed teeth all tend to be slightly more prevalent among children with defective tonsils than among children with normal tonsils or among those whose tonsils have been removed.

Filled teeth are more prevalent among children whose tonsils have been removed, indicating that the tonsillectomized children are a somewhat selected group, coming from families that are more able or more willing to secure the correction of remediable physical defects in their children.

Height and weight measurements and records of growth in weight over a period of nine months for a group of school children did not show any advantage in the growth of one tonsil group over another. Data from the literature seem to indicate a more rapid growth immediately following tonsillectomy, but this does not appear to continue for any extended period of time.

BACTERIAL FLORA OF GROUND MARKET MEATS¹**OUTBREAK OF FOOD POISONING PROBABLY DUE TO CRAB MEAT**

J. C. GIGER, M. D., D. P. H., Fellow, A. P. H. A., Hooper Foundation for Medical Research, University of California, Berkeley, Calif.; FRANK E. GREER, M. S., and JOHN L. WHITE, M. D., Bureau of Laboratories and Research, Department of Health, Chicago, Ill.

A banquet on September 23, 1926, was attended by approximately 1,600 members and guests of a florists' association at a large hotel in Chicago. A few hours after the banquet some of the guests became ill. Within 24 hours a large number were affected. The symptoms were abdominal cramps, diarrhea, headache, and in some instances nausea and vomiting.

The Department of Health was not notified of the occurrence until September 26, three days later, when an investigation was begun to determine the causative agent. At this time many of the guests had left the city, a fact which rendered it difficult to estimate definitely the number taken sick.

A list of the guests at the banquet was obtained from the local branch of the association; among them were approximately 90 persons who lived in Chicago, and from these, data regarding the number who became ill, the symptoms, the articles of food eaten and not eaten by those who were ill, were obtained.

The data indicated that between 50 and 60 per cent of those present were ill. The information on this point, however, was conflicting. At the same time 1,000 guests, not at the banquet, were being served at the hotel. None of these were taken ill. Moreover the hotel management reported no illness on the part of the waiters and other help, a great many of whom had partaken of food served at the banquet.

From the initial survey of the symptoms of some patients, it was decided that the outbreak was probably one of food poisoning. In order to ascertain the probable cause of the outbreak the following procedure was carried out:

1. All those who had prepared and served the food were required to submit to examination by the department of health. The results of these examinations indicated that none of the personnel of the hotel were carriers of pathogenic intestinal organisms.

2. A list and history of all the foods served at the banquet was obtained. This was checked against the previous list of foods eaten and not eaten by those taken ill and those not taken ill, obtained from the 90 guests living in Chicago. The survey brought out the fact that the food had been properly prepared and handled in the hotel. It showed that most of those who were not sick had not eaten

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the sea food canape (containing crab meat), whereas those who were sick had partaken of it. It was evident, however, that if the sea food was at fault not all of it was contaminated.

3. Samples of several of the lots of foods served at the banquet were obtained and examined at the laboratories of the department of health. These foods included crab meat, ripe olives, pineapples, jelly, mushrooms, drinking water, and charged water. All save the crab meat consistently gave negative results both chemically and bacteriologically. The crab meat, however, yielded an organism, which on preliminary examination appeared to belong to the *Salmonella suipestifer* group. Members of this group are known to be occasionally associated with food poisoning. It is generally believed that this type of organism is of animal origin and gets into food through contamination by rats, mice, etc.

The organism on further and careful study was found to have the following properties:

Morphology.—It was small, Gram-negative, nonsporeforming, and sluggishly motile.

Agar slant.—It gave a moist, smooth, translucent, and abundant growth.

Broth.—The medium became turbid; there was a thin pellicle and some sediment.

Litmus milk.—The medium became acid in 24 hours, and alkaline in 48 hours.

Indol.—The test was negative.

Gelatin.—Gelatin did not show liquefaction.

Sugars.—Dextrose, maltose, mannite, galactose, trehalose, xylose, and dextrin were fermented with production of acid and gas.

Arabinose, levulose, and rhamnose were fermented with acid production but no gas.

Adonite, erythrite, inosite, inulin, lactose, melezitose, raffinose, salicin, and sucrose were not fermented.

Culturally the organism resembled the *Salmonella suipestifer* very closely.

In order to ascertain more fully whether the organism might be *S. suipestifer*, it was tested against suipestifer antigen obtained from the University of Chicago and against antisera from rabbits injected with pure cultures of *S. suipestifer*, obtained from the University of Chicago and from the American Type Culture Collection. Six such strains were used to immunize rabbits and yielded sera of high homologous titre for all save one strain. None of these antisera would agglutinate the crab-meat organism. Immune antisera, obtained by injecting washed cultures of the crab-meat organism, failed to agglutinate the pure live strains of *S. suipestifer*. However, the organism was agglutinated by its own homologous antiserum in high dilutions. The results throw doubt upon the theory that the organism is definitely a member of the *S. suipestifer*. However, some

workers have found that there are certain strains of this group of *Salmonella* which do not agglutinate with heterologous antisera of the species.

To test the pathogenicity of the crabmeat organism on laboratory animals the following experiments were carried out.

The organism was grown in dextrose broth at 37° C. for 24 hours; 1 cubic centimeter of the culture was then injected intraperitoneally into mice. Death occurred within 48 hours in four of the six mice injected. None of the control mice died. Injections of washed suspensions of the organism also resulted in the death of five out of eight mice in 58 hours. The organisms were then grown in a veal infusion broth containing 2 per cent of Witte's peptone, and 0.1 per cent of the dextrose with a final pH of 7.2.

Injection of the cultures, filtrates and washed organisms grown in this broth, all resulted in the death of a high percentage of the mice when 1 cubic centimeter was injected.

Again experiments were tried using Berkefeld filtrates heated to 56°C. for 30 minutes. The heated filtrates did not cause the death of the mice injected.

Some of these results were suggestive of a soluble toxic substance. In order to determine whether we were dealing with a true toxin, attempts were made to obtain protective sera against the filtrate of these organisms. It has been shown by Ecker (1), Geiger, et al. (2), and Branham (3), that members of the paratyphoid-enteriditis group produced soluble toxinlike substances.

Rabbits were therefore injected intravenously at frequent intervals with sterile filtrates of the "crabmeat" organism.

The antisera from these rabbits failed to protect mice injected with the unheated filtrates.

While this work was in progress another investigation was being carried out on the flora of ground meat obtained in the Chicago market. These organisms were isolated by streaking a portion of the sample of ground meat upon the surface of Endo's medium, incubating the plates for 24 hours at 37° C. and picking the colorless colonies from the surface of the medium. The colonies so picked were purified by repeated seeding in fluid Endo's agar at 45° C. and pouring plates for the deep colony method of isolation.

The properties of the 100 organisms thus obtained were studied in the following media: Tryptophan water for 5 days at 37° C. to determine indol production; 14 per cent gelatin for 30 days at 20° C. for proteolytic enzymes; litmus milk and various 1 per cent carbohydrate media for fermentative changes. The reactions were read in litmus milk in 5 and 15 days, while in the carbohydrate media the results were read at the end of 5 days of incubation at 37° C.

Type of organism	Gram-stain	Motility	Gelatin	Indol	Dextrose	Lactose	Sucrose	Xylose	Dulcitol	Mannitol	Rhamnose	Maltose	Inositol	Salicin	Litmus milk	Laboratory numbers
B. <i>Suispestifer</i> group.	-	+	-	-	*	-	-	*	-	*	*	*	-	*	±	1, 2, 5, 7, 10, 11, 14, 22, 30, 31, 35, 51, 61, 65, 69, 74, 76, 80, 81, 82, 85, 89, 93, 94, 95, 96, 100.
	-	+	-	-	*	-	-	*	-	*	*	*	-	+	±	4, 21, 25, 32, 34, 49, 52, 84.
	-	+	-	-	*	-	-	*	-	*	*	*	-	-	±	8, 13, 17, 20, 24, 37, 38, 41, 43, 44, 45, 46, 48, 58, 60, 64, 70, 72, 75, 77, 86, 88, 90, 91, 92, 98, 99.
B. <i>Icteroides</i> group.	-	+	-	+	*	-	-	*	*	*	*	-	-	-	-	36, 47.
B. <i>Proteus</i> group.	-	+	+	+	*	-	*	-	-	*	-	*	-	-	+	3, 6, 9, 15, 16, 13, 39, 54, 59, 66, 7, 78, 83, 97.
	-	+	+	+	+	+	+	-	-	+	-	*	-	-	+	27, 28, 56.
	-	+	+	+	+	+	+	+	-	-	-	*	-	-	+	26, 73.
	-	+	+	+	+	+	+	+	-	-	-	*	-	-	+	53.
	-	+	+	+	+	+	+	+	-	-	-	+	-	-	+	19, 29.
	-	+	+	+	+	+	+	+	+	+	+	+	-	-	+	40, 68.
	-	+	+	+	+	+	+	+	+	+	+	+	-	-	+	42.
B. <i>Cloacae</i> group.	-	+	+	-	*	*	*	*	-	*	*	*	-	-	+	57, 62, 63, 87.
	-	+	+	-	*	*	*	*	-	*	*	*	-	-	+	12, 18, 50, 55, 67, 79.

+ Indicates acid production or positive reaction.

* Acid and gas production.

- Negative reaction.

± Initial acidity, final alkalinity.

Culture 23 proved to be a gram-negative coccus.

Sixty-two organisms of the 100 selected for study agreed substantially in their cultural reactions with the *S. suispestifer* group while two gave reactions similar to *Salmonella icteroides*. The remaining organisms were classified in the *B. proteus* and *B. cloacae* groups.

The organisms tentatively classified as *S. suispestifer* failed to agglutinate with a known *S. suispestifer* antiserum of high titre. The known suispestifer organisms likewise failed to show specific agglutination with antisera prepared from two of the unknown organisms.

These studies combined with the work of Geiger, Ward, and Jacobson (4) on oysters, carried out in this laboratory, indicate that there are a number of organisms associated with various foods, but particularly meat products, that are members of the paratyphoid-enteriditis group. Many of them do not lend themselves to classification with any of the better known organisms. Others fall in the classification of the *B. proteus* or *B. cloacae* group. The presence of any of these groups seems to indicate unsatisfactory sanitary methods of handling of the foods in question and may be responsible for the outbreaks of gastrointestinal nature.

The rôle of these organisms in food-poisoning outbreaks has not been definitely determined, but it is apparent that they are poten-

tially dangerous, for it is well known that several of the better known bacteria of these types do cause food-poisoning outbreaks.

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AN OUTBREAK OF FOOD POISONING ON BOARD THE U. S. S. "CANOPUS,"
ATTRIBUTED TO FISH

By G. A. RIKER, Commander, Medical Corps, United States Navy

At about 10 p. m. on April 13, 1928, four or five members of the crew of the U. S. S. *Canopus* reported for treatment at the sick bay with violent cramps, diarrhea, nausea, and vomiting. Within an hour 25 cases were being treated and by the following morning a total of 50 persons, representing about 10 per cent of the crew, were affected. All cases presented similar symptoms but in many instances the symptoms were very mild.

An immediate review of the day's menu was made and the only article which was considered likely to cause such symptoms was fresh fish, served at the noon meal in the form of baked fish and fish chowder.

The menu for April 13, 1928, was as follows:

BREAKFAST	LUNCHEON	DINNER
Fresh corned beef hash.	Fish chowder.	Beef stew.
Tomato catsup.	Fresh fish (baked).	Cottage pudding.
Corn sirup.	Creamed carrots.	Vanilla sauce.
Bread, butter, and coffee.	Mashed potatoes.	Iced tea.
	Iced tea.	Bread and butter.
	Bread and butter.	

The fish were examined by the senior medical officer at the time of delivery on board by the contractor at about 8 a. m., were then cooked and served for luncheon, baked or in the form of fish chowder. They had the appearance of large Spanish mackerel in shape but the scales had a greater anteroposterior diameter than a mackerel, and the individual fish weighed between 30 and 50 pounds. They were caught in traps that morning, and their appearance seemed to substantiate the contractor's statement that they had not been out of the water for more than a couple of hours.

Each patient reporting at the sick bay with symptoms of poisoning was questioned and without exception they all stated that they had eaten the baked fish or the chowder and in many instances had par-

taken of both. No other article on the menu to which poisoning could be attributed had been eaten by all of the patients. The fish were served to the entire crew except the chief petty officers' mess and also to the wardroom mess. No officer was affected except the supply officer who tasted the fish in the crew's galley before it was served. Practically all members of the crew partook of this article of diet, some stating that they had had generous portions and all stated that the fish was apparently fresh and without unpleasant taste. Four members of the Hospital Corps had also eaten either baked fish or chowder without experiencing untoward effects.

The symptoms of poisoning appeared from 6½ to about 15 hours, but in most cases from 10 to 12 hours, after the suspected food was ingested. In mild cases the symptoms consisted of abdominal cramps and diarrhea. The six patients who were more severely affected had abdominal cramps, profuse diarrhea, nausea, and vomiting associated with slight prostration. No rash or urticaria was observed in any case. Most of the patients had recovered by the following morning, but in the more severe cases the symptoms persisted for about 18 hours.

Mild cases in which there was no vomiting were treated with castor oil. Cases in which nausea and vomiting occurred were treated by gastric lavage with warm water containing bicarbonate of soda or lime water. In addition, Squibb's mixture was given to three patients who had severe abdominal cramps.

It is believed that these cases of poisoning were caused either by toxins resulting from rapid decomposition of one or more of the fish or poison inherent in the fish associated with spawning. Gatewood states that certain kinds of fish furnish a perfectly harmless food if eaten so soon as they are caught, but if allowed to remain even an hour or two uncooked their flesh spoils. It also appears that some fish are poisonous only at certain seasons. The spawning season seems to be the one in which such fish are particularly dangerous and older fish have much greater toxic properties than the young.

Gatewood continues:

The family *Scombridae* or the mackerels, are remarkable for the rapidity of putrefactive changes when taken from the water in warm weather. Therefore, under such circumstances, these fish not infrequently develop toxic properties and are responsible from time to time for many accidents from fish poisoning. Most of them are highly valued as food fishes, the flesh being firm and oily, but sometimes coarse.

The post-mortem changes incident to bacterial life have a prominent position in the subject of fish poisoning which is also complicated by the toxic properties of the flesh of certain fish incident to pathological conditions or toxic properties of their food in warm waters.

If every fish when caught were at once bled and well cleaned (gutted) there would be fewer cases of fish poisoning as the post-mortem changes would be

much less rapid. Soon after death the blood of fish congeals, but when post-mortem changes are advanced it runs out as a dull red more or less odorous liquid when the fish is cut. A fish fit for food should have at least bright unsunken eyes and bright red gills, but in the Tropics even such a fish may have started to decompose internally. Removing the intestines, liver, and roe, and thoroughly cleaning the fish should be done very early, especially in tropical countries. The liver should always be included and also the roe of fish taken in warm waters. Removing the head before cooking is also good policy.

A fresh fish should sink in water. It should also have a certain degree of stiffness as a flabby fish is certainly at least beginning to decompose. In many fish in the flabby state strong pressure between thumb and index finger will cause the flesh to move off, leaving practically only the skin. Such soft flesh shows that decomposition is well advanced. If a fish taken by the tail and shaken up and down gives a cracking sound from the backbone it is certainly not sufficiently fresh for food. Cold storage or packing in ice greatly delays decomposition, but lessens flavor. The ideal method is to keep the fish alive, whenever practicable, until it is time to prepare them for immediate cooking. It is, moreover, a method more often feasible than is supposed.

There are about 200 fish families and more than 12,000 species. Mathematically, the chance of poisoning from the use of a true poisonous fish as food is, in view of their relatively small number, especially those who appear fit for food, quite remote. Yet where fish, especially from warm waters, are consumed there is this danger which should not be ignored.

A SMALL OUTBREAK OF FOOD POISONING ON BOARD THE U. S. S. "ARGONNE" AS A RESULT OF AN UNSAFE PRACTICE

By W. C. ESPACH, Commander, Medical Corps, United States Navy

A small outbreak comprising five cases of food poisoning occurred on board the U. S. S. *Argonne*, July 21, 1928. Five men, members of the 12 to 4 steaming watch developed symptoms of food poisoning about two hours after eating canned corned beef while on duty in the fireroom. In two cases the symptoms were mild while in the remaining three they were severe. Canned corned beef was issued to this watch as part of the steaming ration the night before. The corned beef was removed from the can, placed in a bucket, and cooked by the men over a small electric stove. Some of the meat was not eaten and, being adverse to wasting it, they placed the bucket in a safe warm place for use the following night, when the remaining corned beef was consumed.

The five men affected were seen by the medical officer about 20 minutes after symptoms of poisoning appeared. The onset was sudden and began with a chill. They had continuous severe abdominal cramps without diarrhea and their legs were drawn up by contractions of the abdominal and leg muscles. Vomiting appeared early but persisted for only a short period of time. All had fever, but the highest temperature observed was 101° F. There was general muscular soreness, slight frontal headache, and pallor was noted

after the first symptoms subsided. The pulse, which was about 80 and intermittent, became normal within 24 hours. Respiration was at first labored and from 20 to 24 per minute but returned to normal after vomiting and abdominal distress abated. The urinary findings were not significant. None of the food was available for bacteriological examination.

This was an instance where the men, all old-timers in the Navy, did what they knew was not safe. The can and the contained food were in good condition when issued and there was no reason why the food should have been saved from one night to another, as the night ration was ample. There was no question as to what food caused the poisoning, because only those who ate the left-over food were attacked, and as a small quantity was divided among five no one man ate very much. Two of the patients recovered within a few hours, while the three who were admitted to the sick list were comfortable in 24 hours, though they still felt the effect of their experience

ORGANIZATION OF A QUARANTINE CAMP AT OLONGAPO, P. I.

By G. A. RIKER, Commander, Medical Corps, United States Navy

In accordance with the following dispatches, a quarantine camp was organized at Olongapo, P. I., April 8, 1928:

6 APRIL, 1928.

From: Comdt Sixteenth Navdist.

To: Cmdt Olongapo.

Info: *Chaumont*, *Canopus*.

0006 *Chaumont* arrives Olongapo sixteen hundred on seventh April. Draft of approximately six hundred men will be landed for detention eighth April after breakfast. Take necessary steps prepare for reception, housing, and feeding this draft while in detention for about two weeks. Detention is on account of cases of meningitis and draft must be kept in complete isolation until further orders. Cavite will provide mosquito nets and landing force mess gear; no cots will be provided. Olongapo will provide cleaning gear soap, etc., reporting amount expended after draft leaves. Arrange with *Chaumont* or *Canopus* to land provisions and necessary stores for draft for seven days, balance of provisions to be obtained from Cavite. Messing arrangement left your discretion 1505.

6 APRIL, 1928.

From: Cinc.

To: *Canopus*.

Info: CSDA Comdt Sixteenth *Chaumont*.

0006 Comdr. Kimball will report in charge of quarantine camp to be established for the draft arriving Olongapo on *Chaumont* April seventh. Will detail adequate officer personnel, including medical officer from Sub Div Seventeen, to handle the situation 1850.

Upon receipt of the above dispatches a site was selected which had formerly been used by a marine detachment and which had a number

of dismantled machine shops and other navy-yard buildings. This made it particularly desirable, as these buildings were all very well ventilated and had high ceilings, giving the added advantage of being cool for sleeping quarters. The site selected was in such a location that it facilitated posting a sanitary cordon.

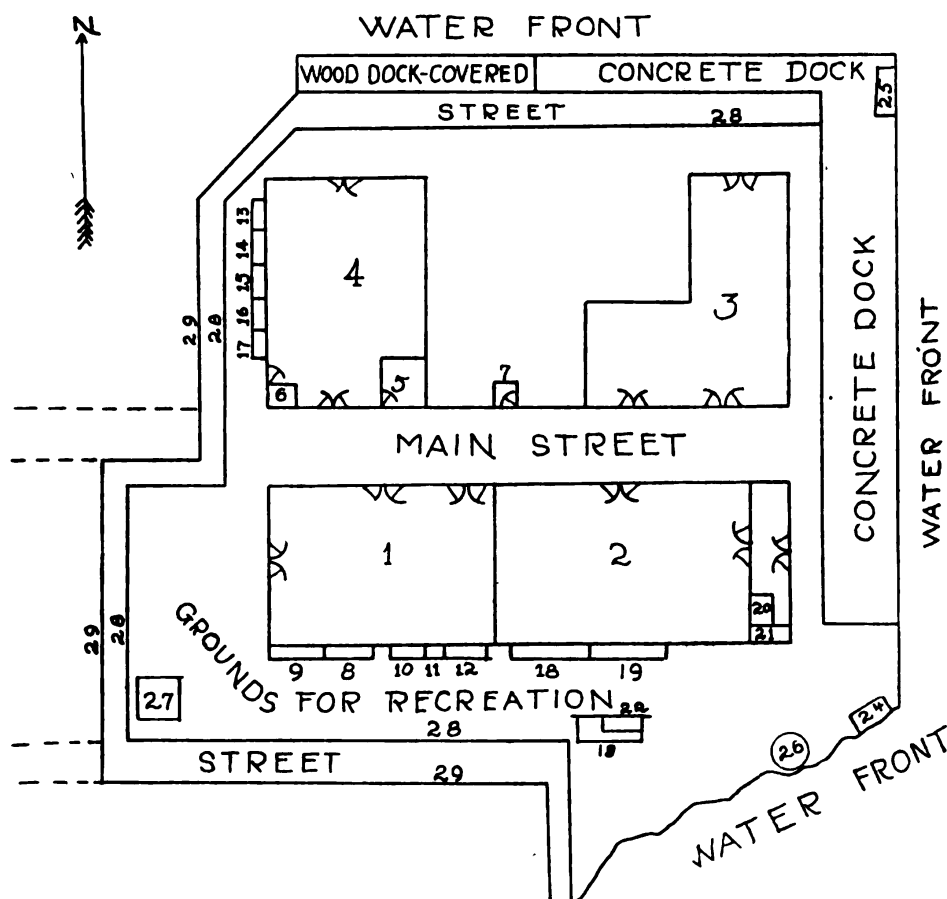


FIGURE 1

The following will indicate on the above sketch (fig. 1) the several activities contained within the camp:

1—Mess hall; about half the space in this building was taken up by mess tables, the remainder used for sleeping quarters. This building was also used for motion picture display.

2 and 3—Sleeping quarters.

4—Sleeping quarters for cooks and mess cooks.

5—Galley.

6—Storeroom for dry provisions.

7—Canteen.

8—CPO mess hall.

9—Band quarters (lean-to).

10, 11 and 12—Sick bay and wards (lean-to).

13, 14, 15, 16, and 17—For isolation of contagious diseases and suspects (lean-to).

- 18 and 19—Additional sleeping quarters (lean-to).
- 20—Draft office.
- 21—Officers' quarters.
- 22—Head (capacity 20 seats).
- 23—Showers (10 shower heads).
- 24—Open head, into sea (15 seats).
- 25—Open head, into sea (used as urinal).
- 26—Garbage incinerator.
- 27—Boxing ring.
- 28—Inside guard line.
- 29—Outside guard line.

Cots complete with mosquito bars, marine field mess gear, and cooking equipment were forwarded to Olongapo by tug from Cavite, P. I. Food and medical supplies were furnished by the U. S. S. *Canopus* and by 10 a. m. April 8, 1928, when the draft was landed, preparation for their reception had been completed, including the erection of long mess tables with benches attached.

One lieutenant and one ensign were assigned from the Seventeenth Division and the U. S. S. *Canopus*, respectively, to take charge of the draft and they remained in quarantine during the entire period. The senior medical officer of the U. S. S. *Canopus* was ordered to take charge of the medical activities. One ship's cook, first class, was ordered from the U. S. S. *Canopus* to supervise the cooking and distribution of food (cafeteria system) at the camp mess. With these exceptions, no personnel other than the draft was quartered within the camp area and the petty officers handled all the activities under the direction of the officers.

The total number of men in the draft as landed was 715 instead of 600 as noted in the dispatch quoted. Of this number, six patients and six Hospital Corps men were transferred to the United States naval hospital, Canacao, P. I., and the remaining 703 remained in the camp until quarantine was lifted on April 24, 1928. An absolute quarantine was established and maintained throughout the entire period. The following suggestions for sanitary regulations were made in a letter to the commanding officer, U. S. S. *Canopus*, on April 7, 1928:

All members of the draft must remain in the inclosure at all times and the patrol should be instructed to maintain this segregation.

All members of the draft to be kept in the open as much as possible during the day and given a reasonable amount of employment.

All bedding to be thoroughly aired and stowed on bunks in a military manner and all buildings must be thoroughly and frequently policed. Squad leaders must be vigilant in seeing that no man sleeps in another man's bunk or uses another's bedding.

All men should be warned against exchanging with one another cigarettes, cigarette butts, pipes, cigars, and passing chewing tobacco, and they should use only their own water buckets and towels.

All mess gear must be placed in boiling water after each meal. A Hospital Corps man should be detailed to see that this is done throughout the entire period.

Regular sick call will be held each morning at 8.30 a. m., but should any man feel sick at any time he will report to the sick bay immediately, regardless of the hour.

Muster of the entire draft will be held daily for the purpose of medical inspection.

Mosquito bars will be kept properly adjusted and inspections made during the night by petty officers of the draft organization to observe the proper compliance of this regulation. Frequent bathing and scrubbing of clothes is recommended with drying of clothes in the sun.

The patrol outside the quarantine area furnished by the naval station and the U. S. S. *Canopus* are not to have contact with members of the draft other than their duties as sentry absolutely require. A patrol formed of members of the draft to be inside the quarantine area should assist in maintaining this regulation.

The men were formed into companies commanded by chief petty officers and petty officers of the draft. Sleeping quarters were assigned by companies. Each company commander was given instructions to place cots as far apart as available room permitted, to see that men slept head to foot, and that mosquito bars were properly secured at night. Regular inspections were made during the night to enforce this order. One company was detailed each day for guard duty to maintain the inside patrol and another as a working and police company. All stores and supplies for the camp were brought to the yard end of the main street by working parties from the U. S. S. *Canopus*. These stores were then handled by the working company of the draft.

Mess gear was sterilized after each meal in boiling water, which was provided in six tubs made by cutting gasoline drums in half. Each drum was filled with water and furnished with a lead from a main steam line which supplied live steam. The mess line formed in the main street in companies and entered the mess hall, where they were served (1 on sketch), by way of the door opposite the galley. At the end of their meal they used another door on the same side of the building as an exit. The six tubs were placed on the outside of that building. The three nearest the exit contained soapy water for washing and the other three clear boiling water for rinsing. This operation was supervised by a Hospital Corps man of the sanitary detail. All garbage was incinerated in the camp after each meal.

There were 15 Hospital Corps men, 2 chief pharmacist's mates, and 13 of other ratings in the draft, and they were of great assistance in caring for the sick and establishing the sanitary routine. Immediately after the draft arrived one chief pharmacist's mate was

placed in charge of the personnel and the general sanitation of the camp. He was then thoroughly instructed in his duties along the lines of the sanitary regulations mentioned in a preceding paragraph. A pharmacist's mate, first class, was detailed as his assistant in this work. The other chief pharmacist's mate was assigned to the ward and sick bay. The remaining Hospital Corps men were given general ward and sick bay details, and they together with all the patients were under his supervision. Two days after the camp was established, however, six of the above-mentioned Hospital Corps men were transferred to duty at the United States naval hospital, Canacao, P. I., by the commandant, sixteenth naval district.

The medical department consisted of sick bay and ward with a small isolation space between the two. The sick bay had the advantage of a toilet, lavatory, and shower. These spaces were in a lean-to marked 10, 11, and 12 in the above sketch. The isolation wards were in a lean-to divided into five compartments, each sufficiently large for three patients, marked 13, 14, 15, 16, and 17 on the sketch. These spaces were particularly convenient as it permitted the isolation of several types of suspects.

Two cases of cerebrospinal meningitis developed April 10, 1928, or two days after debarkation from the U. S. S. *Chaumont*. These cases were immediately transferred to the United States naval hospital, Canacao, P. I.—one via the regular Olongapo-Cavite ferry, and the second via the U. S. S. *Parrott*, which happened to be in port at the time. All men who had been sleeping in the vicinity of the two affected, together with their bedding, were immediately separated from the remainder of the camp. No other cases of cerebrospinal meningitis occurred.

Two cases of mumps, several cases of acute follicular tonsillitis, and one case of Vincent's angina were the only other cases of communicable disease that developed during the encampment. There were a large number of admissions for minor ailments and injuries, but by the time the camp was closed, April 28, 1928, there were no cases of any kind on the sick list and the venereal cases received from the U. S. S. *Chaumont* were practically all off the restricted list.

An inspection of the entire personnel was made each morning during quarters to determine the general physical condition of the men and to find and isolate any case of communicable disease that might have developed. This was followed by a complete inspection of the camp from a sanitary standpoint.

The beneficial effect of fresh air, good food, and recreation was evident within a few days. Primarily, the change of environment

from the close quarters on board ship to the open spaces ashore resulted in a great improvement of the health, contentment, and general well-being of the men. Swimming parties were organized, boxing and other forms of entertainment, including motion pictures, were started, and a service store was opened. All of these activities operated as a decided uplift of the morale. The concrete dock on the water front made an excellent place for scrubbing clothes and an ample amount of fresh water was supplied for that purpose. All of these measures resulted in a remarkable improvement in the appearance of the men and by the end of the first week they were hardly recognizable as those who came ashore in the draft a short time before. The fundamental reason for the camp was the establishment of a quarantine against communicable disease. In this and all other matters, the officers in charge, all the personnel of the camp, together with the officers and men of the U. S. S. *Canopus* and the seventeenth submarine division did everything possible to cooperate with the medical department.

The following is a summary of the medical department expenditures made from the medical department, U. S. S. *Canopus*, during the period of the encampment:

Drugs	\$43.30
Tablets.....	11.46
Biologicals.....	32.68
Surgical dressings.....	74.57
Diets.....	.18
Hospital and nursing supplies.....	25.18
Dispensary and laboratory supplies, miscellaneous.....	6.85
Total	194.22

It has been found from this experience that this section of the navy yard, Olongapo, P. I., is a very suitable section for the quarantine of a draft of between six and eight hundred men, as all the necessary equipment for such camp can be prepared within a short time. It is particularly suitable for isolation from the remainder of the yard, has an ample water supply, good toilet and bathing facilities, and, finally, excellent arrangements for the medical department. This place would be particularly desirable should it be necessary to quarantine a draft for some of the minor contagious diseases, such as mumps, measles, diphtheria, or scarlet fever. There are, however, practically no hospital facilities available and for such a serious disease as cerebrospinal meningitis the long trip to the United States naval hospital, Canacao, P. I., is a drawback. In addition to this, malaria is prevalent in Olongapo. It is therefore necessary in the establishment of any camp that the men be well protected by mosquito nets.

WHAT IS SEMPLE VACCINE FOR RABIES?

The following article is reprinted from the Weekly Bulletin, department of health, city of New York, September 15, 1928:

For many years the health department has employed the Pasteur method of immunizing against rabies. This consists in the use of emulsions of dried spinal cords of rabbits which have been inoculated with a fixed virus. Twenty-one daily injections are required in this method, the strength of the injections being gradually increased as the treatment continues by progressively using cords which have been dried for shorter and shorter periods and which therefore retain more of the rabies virus.

It usually requires about two weeks following the completion of antirabies treatment for sufficient antibodies to form in the tissues of the patient to offset the virus introduced by the biting animal. Clearly, the earlier the treatment can be completed the greater will be the chance of having a sufficiency of antibodies to deal with the virus.

In 1911, Semple, of Calcutta, devised a method of preparing an antirabies vaccine which requires only 14 daily injections to insure immunization. His vaccine has been successfully used in the Pasteur Institute of Kasauli, India, since 1912 and in Palestine since 1923, both localities offering large opportunity for clinical study. Moreover, experiments made at Kasauli, in which animals were immunized with Pasteur vaccine and with Semple vaccine and later infected with fixed virus, amply proved the superiority of the Semple vaccine. In view of these circumstances, the method of production of antirabies vaccine in the laboratory of the New York City Department of Health was changed in August, 1926, from the Pasteur method to the Semple modification. The vaccine is prepared as follows:

Healthy rabbits are inoculated intracranially with fixed rabies virus. When the animals show complete paralysis, on the sixth or seventh day, they are killed. The brains are removed under aseptic precautions, weighed and an 8 per cent emulsion is prepared in 0.8 per cent saline containing 1 per cent phenol. After holding the emulsion for 24 hours at 37° F. an equal volume of sterile saline is added, giving 4 per cent suspension of brain substance in saline containing 0.5 per cent phenol. The exposure to 1 per cent phenol at 37° C. kills the virus, so that the resulting vaccine is no longer infective for rabbits. The vaccine is next tested for sterility according to methods prescribed by the United States Public Health Service, and for infectivity by inoculating healthy rabbits with 0.1 cubic centimeter of the vaccine intracranially. The rabbits must survive for two weeks. The dose is 2 cubic centimeters daily for 14 days and is the same for all cases, regardless of age, sex, or location of the wound.

The Semple vaccine retains its immunizing properties for at least three months, if kept at ice-box temperature and in the dark. This means that it may be bottled and sent to the clinics or to physicians out of town in quantities sufficient for several cases and held ready for emergencies. Formerly with the Pasteur vaccine, it was necessary to make daily shipments to each clinic and to out-of-town cases.

Following is a summary of the reasons in favor of using Semple vaccine:

When kept away from light and in an ice box, the Semple vaccine retains its maximum potency and powers of immunization for a period of at least three months.

Infected brain tissue is said to be ten times more virulent than spinal cord. In using dilutions of brain we are therefore giving a large proportion of

specific antibody-producing substance and less of the useless, possibly somewhat harmful, nerve tissue than is given in methods of cord immunization. We are thus lessening the chances of the development of so-called "post-treatment paralysis" occasionally observed after other methods of treatment.

The dosage is more accurate than in the attenuated cord methods since the cords vary in size. In a large cord, desiccation and attenuation, proceed more slowly than in a small cord. For this reason, the virulence of various cords dried for the same number of days will vary.

Semple vaccine is more convenient as it may be produced in quantity and the whole treatment sent in one shipment.

All doses of the Semple vaccine are the same regardless of age, sex, severity of the bite, or location of the wound. The 14-dose treatment is regarded as sufficient for all types of cases.

Since the virus is killed, physicians or others handling the vaccine are in no danger of infection. The slight danger of temporary paralyses which occasionally follow the use of other methods and which have been attributed by some to the live virus administered, and by others to the foreign protein, has, according to reports to date, been lessened by using this method of treatment.

HEALTH OF THE NAVY

The general admission rate, based on returns for diseases and injuries occurring in July, August, and September, 1928, was 641 per 1,000 per annum, as compared with 527 per 1,000 for the third quarter of 1927 and with the median rate for the preceding five years, which is also 527. The corresponding rate for the second quarter was 551 per 1,000.

The admission rate from disease was 574 per 1,000, which is greater than the expected rate, 463. The admission rate from accidental injuries, 65 per 1,000, was about the same as the experience of previous years.

This increase is accounted for through greater prevalence of acute infectious diseases of the upper respiratory tract. Catarrhal fever exceeded expectancy at several shore stations in the United States. The United States naval training station, Newport, R. I., reported 29 cases in July, 30 in August, and 36 in September; the United States naval training station, Great Lakes, Ill., 41 in July, 72 in August, and 60 in September; and the United States naval training station, San Diego, Calif., 30 in July, 83 in August, and 72 in September. The United States naval training station, Newport, R. I., notified 1 case of cerebrospinal fever in August and 3 in September; the United States navy yard, Portsmouth, N. H., and the United States naval training station, Great Lakes, Ill., reported 1 case each in August. The United States naval training station, San Diego, Calif., reported 10 cases of German measles in July, 6 in August, and 7 in September.

The admission rate, all causes, for forces afloat was 487 per 1,000 per annum for the quarter, as compared with 445, the corresponding median rate for the preceding five years.

The U. S. S. *Ludlow* reported 30 cases of influenza in July, and the U. S. S. *Denver*, 22 cases in August. The U. S. S. *Mississippi* notified 17 cases of mumps in July and 7 in August.

The U. S. S. *Ortolan* reported 1 case of cerebrospinal fever in July, the U. S. S. *Paul Hamilton* and the U. S. S. *Penguin* 1 case each in August, and the U. S. S. *West Virginia* 1 case in September.

The U. S. S. *Utah* and the Sixth Regiment, United States Marines, Tientsin, China, each reported one case of acute anterior poliomyelitis in August. Both cases terminated fatally.

TABLE NO. 1.—Summary of morbidity in the United States Navy and Marine Corps for the quarter ended September 30, 1928

	Forces afloat	Forces ashore	Marine Corps	Entire Navy
Average strength.....	74,581	40,800	19,116	115,381
All causes:				
Number of admissions.....	9,071	9,414	3,939	18,485
Annual rate per 1,000.....	486.50	922.94	824.23	640.83
Disease only:				
Number of admissions.....	8,147	8,420	3,591	16,567
Annual rate per 1,000.....	436.95	825.49	751.41	574.34
Communicable diseases, exclusive of venereal disease:				
Number of admissions.....	2,170	3,405	1,316	5,575
Annual rate per 1,000.....	116.38	333.82	275.37	193.27
Venereal diseases:				
Number of admissions.....	2,682	1,279	783	3,961
Annual rate per 1,000.....	143.84	125.39	163.84	137.32
Injuries:				
Number of admissions.....	906	980	344	1,886
Annual rate per 1,000.....	48.59	96.08	71.98	65.38
Poisons:				
Number of admissions.....	18	14	4	32
Annual rate per 1,000.....	0.97	1.37	0.84	1.11

TABLE NO. 2.—Deaths reported, entire Navy, during the quarter ended September 30, 1928

		Navy			Marine Corps		Nurse Corps	Total
		Officers	Midshipmen	Men	Officers	Men		
Average strength.....		8,822	1,746	85,204	1,193	17,923	493	115,381
CAUSE: DISEASES								
Primary	Secondary or contributory							
Anemia, splenic.....	None.....			1				1
Angina, Ludwig's.....	Septicemia.....			1				1
Appendicitis, acute.....	Obstruction, intestinal, from external causes.....			1				1
Do.....	Peritonitis, general, acute.....			1				1
Do.....	Pneumonia, lobar.....					1		1
Cellulitis, face.....	Thrombosis, lateral sinus.....			1				1

TABLE NO. 2.—Deaths reported, entire Navy, during the quarter ended September 30, 1928—Continued

		Navy			Marine Corps		Nurse Corps	Total
		Offi- cers	Mid- ship- men	Men	Offi- cers	Men		
Average strength.....		8,822	1,746	85,204	1,193	17,923	493	115,381
CAUSE: DISEASES—Continued								
Primary	Secondary or contributory							
Cellulitis, neck.....	Pneumonia, lobar.....			1				1
Cerebrospinal fever.....	do.....			2				2
Diabetes, mellitus.....	do.....	1						1
Encephalitis, lethargic.....	do.....					1		1
Epithelioma, right ear.....	do.....	1						1
Glioma, brain.....	do.....			1				1
Hypernephroma.....	Metastasis, lung and liver.....					1		1
Influenza.....	Pneumonia, broncho.....			1				1
Leukemia.....	do.....			1				1
Malaria.....	Blackwater fever.....					1		1
Do.....	Dysentery, entamebic.....					1		1
Myocarditis, chronic.....	None.....				1			1
Do.....	Pneumonia, broncho.....			1				1
Nephritis, chronic.....	Arteriosclerosis, general.....	1						1
Do.....	Endocarditis, chronic.....			1				1
Do.....	Pneumonia, broncho.....			1				1
Obstruction, intestinal, from external causes.....	Peritonitis, general, acute.....					1		1
Pneumonia, lobar.....	None.....			2				2
Do.....	Nephritis, chronic.....	1						1
Poliomyelitis, acute, anterior.....	do.....			1		1		2
Rheumatic fever.....	Pneumonia, broncho.....					1		1
Sarcoma, mediastinum.....	Pyemia.....			1				1
Syphilis.....	Dementia paralytica.....			1				1
Do.....	Nephritis, acute.....			1				1
Do.....	Poisoning, acute, neoarsphenamine.....			1		1		2
Typhoid fever.....	None.....			1				1
Total for diseases.....		4		22	1	9		36
CAUSE: INJURIES AND POISONINGS								
Primary	Secondary or contributory							
Asphyxiation, illuminating gas.....	None.....			1				1
Burns:								
Multiple, escaping steam.....	do.....			1				1
Multiple, gasoline flames.....	do.....			1				1
Fracture:								
Compound, skull.....	do.....			1		1		2
Do.....	Hemorrhage intracranial.....			1				1
Simple, pelvis.....	Embolism, lung.....			1				1
Do.....	Pneumonia, broncho.....			1				1
Simple, skull.....	None.....			4				4
Simple, vertebræ-cervical.....	do.....			1				1
Do.....	Pneumonia, broncho.....			1				1

TABLE No. 2.—Deaths reported, entire Navy, during the quarter ended September 30, 1928—Continued

		Navy			Marine Corps		Nurse Corps	Total
		Offi- cers	Mid- ship- men	Men	Offi- cers	Men		
Average strength.....		8,822	1,746	85,204	1,193	17,923	493	115,381
CAUSE: INJURIES AND POISONINGS—Contd.								
Primary	Secondary or con- tributory							
Intra-abdominal in- jury.	None.....	1						1
Intracranial injury...	Alcoholism, acute.....			1				1
Injuries, multiple, ex- treme.	None.....			2				2
Landplane crash:								
Injuries multi- ple, extreme.	do.....					2		2
Drowning.....	do.....	2		1				2
Seaplane crash:								
Injuries multi- ple, extreme.	do.....	1						1
Drowning.....	do.....	1		1				2
Wound:								
Gunshot, face and skull.	Intracranial hemor- rhage.					1		1
Gunshot, thorax.	None.....					1		1
Lacerated, jeju- num.	Peritonitis, general acute.			1				1
Penetrating, brain	None.....	2				1		3
Penetrating, chest	Alcoholism, acute.....					1		1
penetrating, heart	None.....			1		1		2
Sunstroke.....	do.....		1					1
Drowning.....	do.....	2		9		5		16
Poisoning:								
Alcohol, acute....	do.....			1				1
Cocaine, acute....	do.....			3				3
Opium, acute.....	do.....					1		1
Total for injuries and poisoning.....		9	1	32	1	13	0	56
Grand total.....		13	1	54	2	22	0	92
ANNUAL DEATH RATE PER 1,000								
All causes.....		5.89	2.29	2.54	6.71	4.91		3.19
Disease only.....		1.81		1.03	3.35	2.01		1.25
Drowning.....		2.27		.47		1.12		.69
Injuries.....		1.81	2.29	.85	3.35	1.56		1.07
Poisoning.....				.19		.22		.17

STATISTICS RELATIVE TO MENTAL AND PHYSICAL QUALIFICATIONS OF RECRUITS

The following tables were constructed with figures taken from monthly reports submitted by naval training stations:

Cumulative data

	Number	Per cent of recruits received	Per cent of recruits reviewed
JAN. 1 TO DEC. 31, 1927			
All naval training stations:			
Recruits received during the period.....	21,323		
Recruits appearing before Board of Medical Survey.....	937	4.39	
Recruits recommended for discharge from the service.....	554	2.60	59.12
JULY, AUGUST, AND SEPTEMBER, 1928			
United States naval training station, Hampton Roads, Va.:			
Recruits received during the period.....	554		
Recruits appearing before Board of Medical Survey.....	34	6.14	
Recruits recommended for discharge from the service.....	34	6.14	100.00
United States naval training station, Great Lakes, Ill.:			
Recruits received during the period.....	898		
Recruits appearing before Board of Medical Survey.....	23	2.56	
Recruits recommended for discharge from the service.....	19	2.12	82.61
United States naval training station, San Diego, Calif.:			
Recruits received during the period.....	799		
Recruits appearing before Board of Medical Survey.....	41	5.13	
Recruits recommended for discharge from the service.....	41	5.13	100.00
United States naval training station, Newport, R. I.:			
Recruits received during the period.....	910		
Recruits appearing before Board of Medical Survey.....	60	7.59	
Recruits recommended for discharge from the service.....	7	.77	11.67

The following cases, selected from reports of medical survey recently received by the bureau, are presented to indicate conditions existing prior to enlistment which led to early separation from the service. These conditions were so evident that the men should have been rejected at their respective recruiting stations:

Visual defects:

Seaman, second class, enlisted at Minneapolis, Minn., March 7, 1927. History of defective vision requiring the use of glasses prior to enlistment. In September, 1928, his vision was found to be 20/50 for each eye. Extensive varicose veins of left leg were also noted. Practically the entire left internal saphenous vein was involved. Surveyed September 17, 1928.

Apprentice seaman, enlisted Pittsburgh, Pa., November 7, 1928. He stated, upon arrival at a naval training station, that his eyes had been defective for the past three years and that he had headaches almost daily. He also complained of backache, the result of injuries received in an accident 10 years ago. Since that time he has suffered from extreme nervousness and tremor. Examination disclosed a man 20 pounds underweight. His spine showed lordosis of the thoracic vertabæ of considerable degree but no tenderness upon pressure. General physical development very poor. There was

a pronounced tremor of both hands and feet. Myopia of both eyes was found. His vision was as follows: O. D. 10/20; O. S. 11/20. His right ankle joint was swollen and tender to pressure. Surveyed November 7, 1928.

Apprentice seaman, enlisted at Raleigh, N. C., August 1, 1928. When examined at a naval training station, myopia, with a vision of less than 3/20 in each eye, was detected. Surveyed August 6, 1928.

Apprentice seaman, enlisted at San Francisco, Calif., September 4, 1928. Upon arrival at the United States naval training station, San Diego, Calif., his vision was found to be 10/20 in each eye due to myopia. He also has an overriding left little toe and a fallen arch of each foot which he states are painful when walking. A report from the hospital stated that a low grade optic neuritis was present and that the visual fields were contracted to 20° in one eye and to 30° in the other.

Otitis media, chronic:

Apprentice seaman, enlisted at Chicago, Ill., September 26, 1928. There was a discharge with a foul odor from the left ear. The left ear drum had a large perforation and was thickened and retracted. Weber test lateralized to the left. Condition was of four years' duration. Surveyed September 27, 1928.

Apprentice seaman, enlisted at Detroit, Mich., September 12, 1928. History of "ear trouble" during childhood and a left mastoidotomy at the age of 10 years. Examination at a naval training station showed left tympanum thickened and retracted with an old perforation near the center. Very slight discharge. Weber test lateralized to the left. Surveyed September 14, 1928.

Deformity:

Apprentice seaman, enlisted at Atlanta, Ga., August 7, 1928. History of a fracture of the skull during childhood with subsequent attacks of diplopia and syncope. He received a fracture of the left olecranon process about four and one-half years ago. There was loss of strength of the left arm and an outward displacement of the forearm when the forearm was extended, causing a loss of the carrying angle, and considerable muscular atrophy of the left arm, forearm, and shoulder. X-ray examination showed an old fracture of the olecranon process, firmly united and in fair position, but there was marked inequality of bony development when compared with the bones of the right arm. He also showed a strong tendency to constitutional psychopathic state, neurasthenia. Surveyed August 28, 1928.

Apprentice seaman, enlisted at New Orleans, La., September 16, 1928. History of a severe infection of right leg six years previously.

following an injury from a barbed-wire fence. Chronic-skin infection of two years' duration. Stated that he has had pains in the back and left shoulder for 18 months. Examination showed scoliosis involving the upper thoracic vertebræ. The left shoulder was about 3 inches higher than the right. There was a deep excavation filled in with scar tissue in the right leg just above the ankle. The chest, abdomen, and back presented a diffuse red macular rash with intermittent pruritis, but no tendency to scaling. Surveyed September 21, 1928.

Tuberculosis of lumbar vertebræ:

Apprentice seaman, enlisted at Seattle, Wash., April 27, 1928. History of pain across back and hips since childhood. Had a psoas abscess which was drained by incision in right groin. An Albee bone graft was inserted during operation when he was 9 years of age. Was hospitalized for three years. Has chills and headaches, but no night sweats or apparent loss of weight. Physical examination showed operation scars over lumbar vertebræ, over left tibia, and in left groin. Pelvis was tilted to the right and left hip more prominent than the right. Spine tender on pressure and motion limited. Kyphosis present, also slight scoliosis with a compensatory curve in thoracic region. Surveyed August 28, 1928.

Absence of teeth, acquired:

Apprentice seaman, enlisted Richmond, Va., August 11, 1928. On reexamination the following teeth were missing: 1, 3, 5, 11, 12, 13, 16, 17, 19, 30, and 32. The following teeth were defective: 2, 4, 14, 15, 18, 20, 21, 28, and 31. Surveyed August 14, 1928.

Defective physical development:

Apprentice seaman, enlisted San Francisco, Calif., August 1, 1928. This man on reexamination was found to have a pronounced kyphoscoliosis with limited mobility of spine, flat feet, deformed toes, and relaxed left inguinal ring. Surveyed August 10, 1928.

Albuminuria:

Apprentice seaman, enlisted Los Angeles, Calif., September 4, 1928. Upon reexamination his urine was positive for albumin and continued positive over a period of two weeks as indicated by repeated daily tests. A few pus and epithelial cells were found, but no casts. He also had flat feet with inversion of the left foot. Surveyed September 20, 1928.

Eczema:

Apprentice seaman, enlisted Baltimore, Md., June 21, 1928. History of eczema both legs over a period of one year. Disease appeared to be of a chronic type and it was assumed that drills and exposure would aggravate the condition. Surveyed June 27, 1928.

Functional cardiac disorder:

Seaman, second class, enlisted Kansas City, Mo., August 6, 1927, when his height was recorded as 69 inches, weight 121 pounds, chest expiration 30 inches, and after inspiration 33½ inches. He was admitted to the sick list on August 18, 1928, with a functional cardiac disorder. Upon physical examination he was found to be underdeveloped and to have a marked curvature of the spine to the left. His chest measurement was 2 inches below the minimum for his size and age and was associated with a rapid and irritable heart. Surveyed August 18, 1928.

ADMISSIONS FOR INJURIES AND POISONING, THIRD QUARTER, 1928

The following table, indicating the frequency of occurrence of accidental injuries and poisonings in the Navy during the third quarter, 1928, is based upon all Form F cards covering admissions in those months which have reached the bureau:

	Admissions, July, August, and September, 1928	Admission rate per 100,000, per annum	Admission rate per 100,000, year 1927
INJURIES			
Connected with work or drill.....	927	3,214	2,913
Occurring within command, but not associated with work.....	578	2,004	1,821
Incurred on leave or liberty or while absent without leave.....	381	2,321	1,097
All injuries.....	1,886	7,538	5,831
POISONING			
Industrial poisoning.....	12	42	37
Occurring within command, but not connected with work.....	7	24	104
Associated with leave, liberty, or absence without leave.....	13	45	35
Poisoning, all forms.....	32	111	176
Total injuries and poisoning.....	1,918	6,649	6,007

Percentage relationships

	Occurring within command				Occurring outside command—leave, liberty, or A. W. O. L.	
	Connected with the performance of work, drill, etc.		Not connected with work or prescribed duty			
	July, August, and September, 1928	Year 1927	July, August, and September, 1928	Year 1927	July, August, and September, 1928	Year 1927
Per cent of all injuries.....	49.1	50.0	30.7	31.2	20.2	18.8
Per cent of poisonings.....	37.5	21.2	21.9	59.1	40.6	19.7
Per cent of total admissions, injury and poisoning titles.....	49.0	49.1	30.5	32.1	20.5	18.8

Poisoning by a narcotic drug or by ethyl alcohol is recorded under the title "Drug addiction," or "Alcoholism," as the case may be. Such cases are not included in the above figures.

The following cases, selected from July, August, and September, 1928, reports, are worthy of notice from the standpoint of accident prevention:

Firearms, careless handling of.—A corporal, United States Marine Corps, while cleaning a pistol without removing the bolt as required by existing instructions accidentally discharged the weapon. He received a puncture wound of the right lower leg. Loss of time, 45 days in a hospital. This case was reported as "Due to his own negligence."

A private marine with six months' service, having failed to remove the bolt, accidentally discharged a pistol which he was cleaning. Another marine who was standing near by received a perforated wound of the abdomen and a compound fracture of the left humerus. The injured marine was treated in a hospital 91 days.

A trumpeter, United States Marine Corps, had neglected to remove the cartridges from an automatic pistol which he was cleaning. He received a puncture wound of the distal phalanx, left thumb, when the pistol was accidentally discharged. Loss of time, three days.

The Army Training Regulations, T. R. 150-5, paragraph 38 (f), provide as follows: "The barracks cleaning rod only will be used. The use of the thong and brush will be confined to occasions when the barracks cleaning rod is not available. Rifles will always be cleaned from the breech, the bolt removed during the cleaning for this purpose."

Gasoline hazards.—Gasoline which was spilled near the engine became ignited by a spark caused by backfire when the motor was started immediately after the gasoline tank had been filled. A fireman and a chief torpedoman were burned about the face and hands. Loss of time, six and nine days, respectively.

A private marine detailed to duty as a cook attempted to start a fire in a stove with gasoline. A cup containing the gasoline, which became ignited, was thrown outside the building and struck another marine who was passing. His trousers were set on fire by the burning liquid and caused a severe burn of his right leg. Loss of time, 32 days.

Accidents from gasoline hazards usually occur as a result of direct violation of Instructions, Bureau of Construction and Repair, Section VIII, articles 3237 and 3238, which are as follows:

3237. Gasoline—Gas fumes—Ventilation.—On all vessels equipped with gasoline as the main fuel, such as submarine chasers and small patrol boats, the danger of gasoline fumes collecting in inclosed spaces, living quarters, and bilges, is great, due to slight leaks in pipe lines and stuffing boxes, and when the

fuel tanks are being filled. The gases will usually collect in the lowest part of the boat. It is therefore extremely important that these spaces be ventilated daily for at least one hour; if no blowers are installed for this purpose, the spaces should be opened up for natural ventilation and bilge pumps should be run for at least one hour after the bilges are pumped dry; these precautions should be taken whether or not gasoline has been taken on board or transferred. All hatches and air ports should be closed while filling the tanks to prevent the gasoline vapors from finding their way below decks. After filling the tanks, the compartments should be ventilated to clear them of any fumes which may have collected.

3238. *Accumulation of gas in bilges.*—(1) Explosive mixtures of gas and air accumulate in the bilges of POWER BOATS when the bilges are not kept dry, and particularly in cold weather when condensation of gas in the intake pipe of gasoline engines is increased. Bilge pumps are fitted on some engines for the specific purpose of keeping the bilges dry and clear of gas; on others, dependence is placed on hand pumps. All power boats are fitted with pumps with which to keep the bilges dry. Failure of the personnel to use these pumps for that purpose results in the formation of an explosive mixture of gas and air in the bilges, which may be ignited from backfires or in unforeseen ways by sparks.

(a) Bilges shall be frequently washed out to clear them of gasoline, gasoline vapor, and oil. They should be washed before hoisting the boat into the boat skids. The majority of gasoline fires and explosions are due to the presence of gasoline, gasoline vapor, and oil in the bilges. Ventilation is of prime importance as a means of expelling or dissipating gasoline vapors that may be present.

Hatch cover hazards.—Through the carelessness of others, a hatch cover was improperly secured. A man in descending the ladder received a fracture of the middle phalanx of the third and fourth fingers, when the cover fell. Loss of time, 94 days in a hospital.

In another case, an improperly secured cover fell while a man was passing through the hatch. He received multiple wounds of the head, left elbow, and wrist. There were no sick days.

Careless handling of food-products machinery.—An apprentice seaman with three months' service was sharpening a knife on an emery wheel attached to a meat grinder. He turned the electric switch off, but put his hand into the grinder before the machine stopped. Avulsion of the second and third fingers of his right hand resulted. Loss of time, 59 days in a hospital.

A ship's cook, while testing a meat grinder for a loose part, accidentally struck the switch with a dishpan, starting the machine in motion. His left hand was caught in the moving parts and avulsion of the distal phalanges of the second and third left digits resulted. Loss of time, 22 days.

Careless handling of machinery.—A carpenter's mate, first class, neglected to close the steam supply and exhaust valves before cleaning an anchor engine. His right hand was struck by a connecting rod when he accidentally started the machine. A lacerated wound of

the hand resulted and the extensor pollicis brevis and abductor pollicis longus muscles were torn from their insertions. Loss of time, 29 days.

Lack of safety device.—A fireman, third class, received burns from escaping hot water while working with an evaporator pump to which no drain was attached. Loss of time, 13 days.

Unsafe practice—Lack of eye protection.—A ship fitter, working without goggles in the glare of an electric welding torch, developed an irritation of the eyes. It was stated that there were not a sufficient number of these protective devices on board. Loss of time, one day. This case was reported as "Negligence not apparent."

Unsafe practice—Lye solution.—A seaman, second class, with only six months' service, received chemical burns of both feet. He was "swabbing down the deck" in his bare feet with a solution of lye. Loss of time, 12 days.



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TRUMAN H. NEWBERRY,
Acting Secretary.

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PREFACE

THE UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April, 1907, as a means of supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to the naval medical officer, reports from various sources, historical essays, notes and comments on topics of medical interest, and reviews or notices of the latest published medical books.

The bureau extends an invitation to all medical officers to prepare and forward, with a view to publication, contributions on subjects of interest to naval medical officers.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of commendation to authors of papers of outstanding merit and will recommend that copies of such letters be made a part of the official records of the officers concerned.

The bureau does not necessarily undertake to indorse all views or opinions which may be expressed in the pages of this publication.

C. E. RIGGS,
Surgeon General United States Navy.

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Contributions to the **BULLETIN** should be typewritten, *double spaced*, on plain paper, and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication. For example, addresses, dates, etc., not a part of the article, require deletion by the editor. The **BULLETIN** endeavors to follow a uniform style in headings and captions, and the editor can be spared much time and trouble, and unnecessary changes in manuscript can be obviated, if authors will follow in these particulars the practice of recent issues.

The greatest accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible for the editor to understand or verify references, quotations, etc. The frequency of gross errors in orthography in many contributions is conclusive evidence that authors often fail to read over their manuscripts after they have been typewritten.

Contributions must be received two months prior to the date of the issue for which they are intended.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustrations, if not original, should be accompanied by a reference to the source and a statement as to whether or not reproduction has been authorized.

The **BULLETIN** intends to print *only original articles, translations, in whole or in part, reviews, and reports and notices of Government or departmental activities, official announcements, etc.* All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere without an understanding to that effect.

U. S. NAVAL MEDICAL BULLETIN

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SPECIAL ARTICLES

FUNDAMENTALISM AND MODERNISM IN PSYCHIATRY

By KARL A. MENNINGER, M. D., Topeka, Kans., Former Lieutenant (junior grade), Medical Corps, United States Naval Reserve

Psychiatry has been called the Cinderella of medical specialties. For years this ragged waif sat alone by the fire in the kitchen, while her proud sisters Laryngology and Pediatrics strutted in the parlor. Sister Surgery was there, too, quite the queen of them all, forgetful of her humble origin in the barbershop, and Mother Obstetrics was never reminded of her poor relations, the Midwives.

When by the fairy godmother's aid the transformed Cinderella (Psychiatry) appeared at the great ball (the war), she outshone all her sisters. It was there she won the prince's favor, i. e., popular esteem, and thereafter came out of the kitchen and consorted with her fashionable and now deferential sisters, and at last she married the prince.

This allegory is peculiarly apt. It sketches the development of psychiatry from the sterile, stagnant "asylum" period to the present unparalleled popularity of a speciality which because of its inclusiveness and its comprehensive grasp might even be considered the keystone of medical science.

The fairy godmother responsible for these great changes is a melioristic philosophy which kept alive embers of hope in the hearts of the early psychiatrists whose task was generally regarded as hideous and hopeless. The patients relegated to them were the mad, the moon-struck, the lunatic, the alien, the devil-possessed, the idiotic, the demented, the insane. The very words are hideous, and their origins and meanings indicate the prevailing sentiments of aversion with which those afflictions were held.

Such feelings of aversion emanated from—

1. The hopelessness, ignorantly ascribed to such cases.
2. The helplessness of early medical science to understand or relieve them.

3. The persistence of superstitions and religious hypotheses dealing with their origin, their relation to sin, devils, evil spirits, etc.

Of these, certainly the third has been the most powerful. Madness has for centuries been taboo, i. e., both sacred and accursed. The taboo still attaching to it on the part of the rabble is betrayed by the archaic language of the law, but the progress of medical science and the extension of knowledge has lifted the taboo for the intelligent. The bereft were found to be less hopeless than at first they seemed, and the increasing demands of civilization upon poor mortal frames had so increased the approximations of supposed "normals" to the symptomatology of insanity that familiarity replaced taboo with toleration and with the crusading spirit of modern preventive medicine.

It was the far-visioned hopefulness and the indefatigable spirit of the early innominate who observed and examined and nursed and protected the insane that formed the basis of modern psychiatric prestige. In the years when leeches and bloodletting and purges were the stock in trade of the practicing profession, Pinel in France, Tuke in England, and Dorothea Dix in this country were insisting that, all signs and customs to the contrary, the mentally sick were really human beings and deserved consideration as such and treatment for their sicknesses. It was one step to substitute beds for heaps of hay, and another to replace whips and nakedness with even primitive decency and comfort. The progressive addition of sedatives, dietary care, nursing efforts, antisiphilitic therapy, hydrotherapy, etc., followed slowly.

Meanwhile there were accumulating data of these allegedly sick persons—psychological data, histological data, chemical data. An American association was formed (now 80 years old) of those physicians interested in these phenomena. Notes were compared, cases reported, brains examined. Gradually an increasing nosology grew up. From the old unitarian conception of madness or insanity there was first a revival of the preceding Greek (Hippocratic) partitioning into mania, melancholia, and dementia. Then all manner of varieties of each were described and what with kleptomania, pyromania, hypomania, monomania, acute mania, puerperal mania, delirious mania, etc., together with similar multiplications of the other two fundamental pictures, the nomenclature of psychiatry became almost as elaborate and formidable as that of the dermatologists. Accordingly the balance of the medical profession, previously disdainful, was left astonished, bewildered, and thoroughly convinced that psychiatry was an illegitimate child, still deserving of kitchen service, in spite of these evidences of erudition.

The extreme of this pluralistic view of psychiatry was marked by the Wernickean conceptions of individualization, every patient a case *sui generis*, subject to description but not to classification.

It was Emil Kraepelin, of Munich, whose synthesizing genius brought order out of chaos. In a series of editions of a comprehensive treatise he coalesced certain similar clinical pictures into what he regarded as disease entities, and substantiated such groupings by showing certain general similarities in origin, symptomatology, course, termination and pathology (assisted in the latter by Nissl). From a mass of thousands of syndromes and names, he finally achieved a classification of approximately 100 psychiatric entities, his most familiar creations being "Dementia præcox" and "Manic depressive psychosis." Kraepelin also deserves the credit for these two atrocious names.

During the first 20 years of this century these new formulations of Kraepelin's were engaging the attention of psychiatrists the world over, and soon became the dominant nosological conceptions. The clinical workers in State hospitals were chiefly engaged in observations and descriptions of cases falling in one or another of Kraepelin's groups. This indeed was the maturity of the era of descriptive psychiatry, the golden age of fundamentalism. Characteristic of it was the descriptive and diagnostic attitude of the observers. The perceptual, intellectual, emotional, and volitional faculties were scrutinized in all their pathological variations; groups of symptoms and groups of cases were analyzed, brains sectioned and stained and correlations of various sorts attempted between symptom and structure. The heyday of neuropathology was coincident, and was the bridge of contact with the organic neurologists, whose established respectability lent some prestige to the rising sister specialty. The elaborate staining methods of Alzheimer, Nissl, and Pahl, Van Giesen, Weigert, and Cajal previously applied to structural lesions of the cord and brain in traumatic and infectious and degenerative conditions were applied in these increasingly interesting mental aberrancies. The poverty of results discouraged no one.

Meanwhile the administrative attitude toward the mentally sick had steadily improved. Asylum provision was made increasingly comfortable, and the hospital rather than the asylum became the ideal. Pathologists and clinical directors were added to the staffs. Numerous therapeutic agents were added—pharmaceutical, hydrotherapeutic, electric, etc. The small diagnostic unit or "psychopathic hospital" became the vogue in various States. Specialized institutions for certain forms of mental disease were established such as epileptic and feeble-minded hospitals and colonies.

Diagnosis was the keynote of this era, of psychiatric fundamentalism. The psychiatrists lent most of their efforts in this direction with of course a perfunctory concern with the routine custodial care of committed cases.

But the war turned the tables. Entering insignificantly at the back door, psychiatry emerged with enormous experience, enormous accomplishments, enormous prestige. The psychiatrists learned for the first time that they could be useful outside of asylum walls. They demonstrated that they had a province in war almost as extensive as and little less spectacular than the great realm of surgery itself. Unnumbered legions of patients with mental incapacities were referred to hastily organized psychiatric centers, not for mere labeling or diagnosis, but for rapid rehabilitation. Thousands were sent promptly back to active service. The psychiatrists overcame their ancient sense of inferiority and demonstrated to themselves and to the world that they could do something, something more than labeling various types of institutionalized wrecks.

This practical demonstration of efficacy moved psychiatry into the major leagues of medical specialties. It established definitely the therapeutic rather than the merely diagnostic function of the psychiatrist. This ushered in the beginning of modernism in psychiatry, and ushered out old conceptions and terms such as lunacy, and insanity alienist, and psychiatrists became physicians, healers of the mentally sick—and ceased to be alienists, or mere legal quibblers and nominators.

But the war did more than give this practical demonstration of psychiatry's utility. It marked the emergence into clear view of the phenomena of mental functioning not subjectively visible to the patient, i. e., unconscious or subconscious mentation. Data had long been accumulating through the researches of Charcot, Bernheim, Janet, Prince, and Freud, theories and countertheories had been advanced, but there had been no general agreement with or acceptance of any of them. The phenomena observed in the acute mental disturbances seen in the war offered a great mass of illustrations in clear relief. It was obvious to even the most skeptical and inexperienced that so-called hysterical symptoms appeared as escape mechanisms in susceptible weaklings caught between two unbearable alternatives, without any conscious subjective recognition of the motive or mechanism.

Observers thus initiated were not long in pointing out that "shell shock" psychology occurred in business and home as well as in war and camp. The psychiatrists found themselves in touch with the psychologists and both found a world prepared for and desirous of their attention to its wounds.

What had been discovered was that the behavior of human beings was to be regarded as instinctive adaptations for which unconscious rather than conscious motivation was chiefly responsible. Of course this had been proved and reiterated long before the war but no one believed it. The full force of the realization that man is not consciously master of his conduct any more than of his lungs or liver was too bitter a blow to human self-esteem. It only became inescapable when the war elicited thousands of simple examples. Entirely new mechanisms were discovered in widely diverse types of material, and entirely new psychological conceptions sprung up. The whole emphasis of psychology changed from static to dynamic concepts, from the sensation as a unit of experience to the wish, from what is felt to what is willed. The psychic process took form as a continuous flow from perception through intellection and emotion to volition and conduct, driven on by the will to live and to procreate, through a series of love situations. In the interruptions in the smooth running of this process, the psychiatrist found himself interested. Interested he was no longer in describing and labeling end-states of breaks in the process, but in localizing and removing the lesions. And with this change in point of view came an immensely widened field. Once only the noisy and violent, or the deluded and hallucinated were considered mentally sick. Now those who are unhappy are mentally sick, those who are inefficient, those who are grouchy, those who are irritable, those who are depressed; in short, those who have difficulty in getting along with themselves or with other people. Inability to get along constitutes mental ill health and indicates failure in the machinery of adaptation of natural instincts to the demands of society and civilization.

We think of the human organism as striving for personal and social recognition, establishment and perpetuation—driven by the two great urges of ego and sex. Once social disorganization permitted direct measures for the gratification of these primitive desires. But as organization, socialization, discovery, invention, and intelligence grew, the necessary restrictions on direct and inconsiderate indulgences grew. The family expanded into the tribe and the formula of kill or be killed became modified to live and let live as respects certain tolerable additions to the fold. The affection once limited to sex objects became transmuted to an affection for cooperative colleagues, and the sentiments of gratitude, sympathy, and loyalty crept timidly into the developing psyche of man.

To this day the drives of man are obviously sex and self, modified by restrictions imposed from within and without by tradition, custom, instruction, example, law, or fear. In childhood much of the

psychic evolution undergone by primitive man is repeated, just as embryology has shown an anatomical recapitulation, and it is during the formative years prior to adolescence that the patterns of adaptation are formed—i. e., the attitudes, interests, reactions, repressions, directions of love and desire. In certain adult cases it is possible and necessary to go back to childhood days to discover and remove a stone that has disastrously deflected the stream of mental life. This is the objective of psychoanalysis, the technique of which can not be discussed here. But from what has been learned by psychoanalysis, by genetic psychology and by child study, we know that the prevention of such deflections, damnings, and distortions is possible and desirable, and far easier than their subsequent correction. Hence the advent of the child guidance clinic, clinics devoted to the study and correction of behavior problems in children. To one unacquainted with their scope and achievements their enormous popularity and service can not be imagined.

It is not in the behavior problems of children only that modern psychiatry is interested. However, it is through the knowledge gained from the psychiatric study of children that we have learned much in theory and technique with regard to misbehavior in adults. And because every child is a little criminal in the sense that he wilfully fractures social prohibitions, we have learned much of the hitherto obscure region of adult criminal psychology.

For since modernistic psychiatry is concerned in explaining abnormal behavior, there is no justification for the theoretical separation of the insane and the criminal (whatever practical advantage there may be). Such labels and the attitudes they indicate were formulated many centuries ago. Science, fortunately, has advanced during this time.

Once all fevers were called just "the fever," just as we yet call all misconduct of one type just "crime." Now we know that typhoid fever, scarlet fever, yellow fever, pneumonia, and other fevers differ widely and that fever is a symptom and not a disease. Similarly we must regard theft, murder, vagrancy, etc., as symptoms and not as disease. Incidentally we have made certain that the offense for which a criminal is apprehended is rarely, if ever, the first symptom, any more than is the fever the first symptom of any disease.

Treatment of conduct disorders of the prescribed types for which society ignorantly supposes it understands the motives and hence stigmatizes and punishes, is not yet uniformly in the hands of the psychiatrists. If it were, it is certain that individuals found to be possessed of mental machinery inadequate to social readjustment would not be permitted freedom, as the present stupid parole system

permits, so that their aggression and offensiveness against society continues. Criminals would be paroled only when their mental status had changed—not simply when their sentences expired. If their mental defection were of a sort that didn't change, in the prison they would remain, indefinitely.

Once not so long ago doctors treated every symptom according to principles laid down in a book, principles of Hippocrates, Paracelsus, Galen, et alia. From the precedents of these masters there could be no departure. In this futile, stupid way the social or behavior diseases are still treated by the lawyers. Instead of fitting a treatment to an individual, offenders are for the most part treated according to opinions and enactments hundreds of years old, solemnly applied by mechanical judges serving up mediaeval stupidities in the name of "precedent," "public policy," and other defenses of archaic legal and religious systems.

In many cities there are developing psychiatric clinics in connection with courts so that after the process of establishing guilt or innocence, the judge may be advised by the psychiatrist as to the best disposition of the case for the sake of himself and of society. Many legal difficulties hamper this type of treatment, but slowly the doctors are taking criminology from the politicians, just as long ago they took surgery from the barbers.

In the private practice of all psychiatrists, of course, cases of which crime is the presenting symptom are very common now—and cases of many other sorts once regarded merely as sins, moral obliquities, temperamental twists, and perversions are more and more referred to psychiatrists for treatment instead of to preachers or judges for scolding or punishment. This is not to decry the preacher of religion for, in fact, religion must be regarded as the earliest and best and most universal mass psychotherapy. The psychiatrist has joined the minister in healing sick souls.

For it is indisputable that healing is possible in certain cases—in the great majority of cases. No greater illusion prevails than that mental sickness has in general a bad prognosis. Precisely the reverse is true. The majority recover. It is the psychiatrist's task to expedite this recovery and to protect society until such recovery has occurred. To the degree that psychiatry has already demonstrated her therapeutic potency she owes her present rising prestige. "By their fruits ye shall know them."

Not all psychiatrists agree on details of diagnosis or treatment, or ever will in the nature of things, because psychiatrists are scientists, not creedists. But we are of one mind in our attitude of applying science to the understanding and correcting of human misbehavior (rather than merely to its description or to its punishment). This is modernistic psychiatry.

DERMATOMYCOSIS AND ITS TREATMENT

By E. A. SHARP, Lieutenant Commander, Medical Corps, United States Navy

Fungus infection of the hands, feet, axillæ, and genito-inguinal region is still being treated deferentially in current medical literature. Recently the lay press has culled information about the disease from medical periodicals and more or less properly revamped it to fit popular needs.

Therefore, from all sources, it seems agreed that "dhobie itch" can never more serve as a hall mark of tropical habitat. Mr. Babbit is being made to realize that his "soft corns" are not caused by ill-fitting shoes; and interdigital "dead skin" is not the result of negligent drying of his feet following ablutions. In short, the medical profession and the general public are becoming endued with the established fact that the "epidermomycoses," a designation suggested by White and Greenwood (1), exist universally.

OCCURRENCE OF FOOT MYCOSIS

Statistics covering large groups of people to determine the incidence of the common clinical varieties of mycoses are not abundant. Weidman (2) found ringworm of the toes in 67 per cent of a small group of students. Notwithstanding that high rate of incidence it is believed that surveys in the military service will show rates exceeding it. Within the last several months 723 officers and men of the Naval Establishment on duty in this locality¹ were examined for clinical evidence of "dhobie itch" of the feet. The acute and chronic types were found in 517, or 71 per cent, of those examined. Laboratory observations to substantiate the diagnosis were made from a negligible number of cases in this series. Generally speaking, it has become routine in the medical wards to look for fungoid dermatitis and treat it along with the major disability, so frequently is it found to exist on the hands and feet. Eichenlaub (3) has observed tinea cruris, tinea eczema, tinea versicolor, and unclassified tinea in 837, or 61.23 per cent, of 1,381 tuberculous and nontuberculous patients examined. Hazen (4), in office practice, found 161 patients out of a total of 1,800 consecutive new cases had eczematoid ringworm; 100 were males and 61 females. Most observers agree that it is far more common in males than females, but it is decidedly not uncommon in females.

TYPES OF FUNGUS INFECTION ORDINARILY FOUND

The eczema marginatum of Hebra, ringworm, eczematoid ringworm, tinea eczema, interdigital hand and foot itches, intertrigo and

¹ Hawaiian Islands.

recurrent pruritis on any area of the body (too often considered as due to "too much acid in the blood") should be investigated microscopically for the presence of fungi. White (5) has reported a series of cases with ulceration on the feet and ankles in which he found evidence of occlusive endarteritis. Eight cases with ulcers on the feet and ankles have been treated by me and numerous others seen in consultation in recent months. Circulatory disturbance did not seem to be a feature in any of them. The youngest of the group was 25 years of age and the eldest 45. Three were discharged from the service on account of a persistent eczema sicca of the ankles.

The majority of the prevalent dermatomycoses are caused by species of *Epidermophyton*, *Trichophyton*, and *Microsporon* as has been demonstrated by Butler (6), White (7), and many others. Cultural methods of study are conclusive in determining the specific species of the invader but the way is difficult. To produce and interpret cultural results requires mycologic knowledge limited to a small number of workers in the field. A microscopical diagnosis is readily made from skin scrapings. On the other hand, a clinical diagnosis can not be discounted when laboratory facilities are limited.

TREATMENT OF THE EPIDERMOMYCOSSES

The treatment of fungus infections is the matter of greatest concern to those who recognize its presence. There is a preponderance of opinion tending to show that the disease is: (1) Self-limited to a certain degree; (2) more active in warm, moist climates; (3) prone to become chronic with periodical exacerbations accompanied by slight, if any, disability; and (4) responsive to most any form of persistent local treatment.

Prevention of infection may be effective when it becomes possible to avoid dermal contact in bathing beaches, swimming pools, bathroom floors, public lavatories, shaking hands, hand rails, door knobs, etc. The potentialities of prevention evolves a fertile resource for another phobia.

In the treatment of ringworm of the general surfaces Sutton (8) recommends daily applications of tincture of iodine; also, aqueous solution of sodium hyposulphite (10 to 20 per cent), and ammoniated mercury ointment. Pusey (9) uses metaphen, 1:500, in foot mycosis after the bullæ are broken; further, he employs wet dressings of aluminum subacetate N. F., 8 per cent solution, and substitutes potassium permanganate in aqueous solution of a strength of 1 to 3,000 after the acute stage has subsided. Whitfield's ointment is recommended by many as a valuable remedy in the resistant hand and foot infections.

Opinion seems to agree as to the amount of stress placed on the obliteration of vesicles and bullæ in the acute state. Vesicular manifestations are essentially found in the hand and foot mycoses. The usual recommendation is to clip the vesicle in order to expose the infected base.

The chronic mycoses are most frequently of the hands and feet. Inasmuch as crural and axillary infections seldom are resistant to treatment, acute forms are most frequently encountered. There are a certain number which become chronic through inattention of the patient or inadequate treatment by the physician.

In order to achieve success in treatment it should be unnecessary to recommend individualization as a rational procedure. Nevertheless, the fact that skins are different, patients pursue divergent hygienic practices, and various species of fungi react recalcitrantly to ordinary reagents, are all factors governing the end result of proper treatment. After thorough and painstaking endeavor to standardize a treatment for fungus infection, aiming toward simplicity, it is admitted that experienced supervision of any routine treatment is of paramount importance.

For the past three or four years the following treatment of acute and chronic hand and foot infections has been found to be the most efficacious:

(a) Scrub the affected areas with a small, soft-bristled brush, using warm water and tincture of green soap. (A soft toothbrush is well suited to the purpose.)

(b) After scrubbing, dry parts with a soft cloth.

(c) Apply 95 per cent alcohol and allow to air dry.

(d) Deeks' ointment is rubbed into the affected parts and then a liberal excess is applied, covered by cotton and left on overnight.

(e) The ointment may be removed in the morning by talcum powder before bathing.

(f) Repeat the procedure each night until desquamation is complete, all parts have been treated, and no more vesicles, papules, or macules are observed.

Deeks' ointment (10) is composed of these constituents:

	Parts
Salicylic acid.....	4
Bismuth subnitrate	10
Mercury salicylate.....	4
Oil eucalyptus.....	10
Lanolin.....	
Petrolatum aa qs ad.....	100

Myers and Thienes (11) after experimenting with the fungicidal activity of volatile oils reached the conclusion that thymol, cinnamon, and clove possessed fungicidal property to a more considerable extent

than any others. Therefore, the original formula of Deeks has been revised:

	Parts
Menthol.....	7
Salicylic acid.....	4
Mercury salicylate.....	4
Bismuth subnitrate.....	10
Oil of eucalyptus.....	10
Oil of cloves.....	10
Oil of thyme.....	10
Alcohol.....	5
White wax.....	5
Lanolin qs ad.....	100

The original formula by this revision must be placed in the category of the well remembered "shotgun" class. As it has not been used in a large series of cases, having been employed only a few months, its increased efficacy can not be proven. It has two worthy improvements, however: (1) The base in the revised formula adheres to the skin with little saturation of the dressing and its penetration seems to be adequate; and (2) the addition of the volatile oils has minimized the objectionable odor.

It will be noted that clipping of vesicles and bullæ has not been recommended in the outline of treatment. Scrubbing is usually sufficient to break down these lesions. At any rate, the ointment possesses keratolytic properties to the degree that the epidermis is macerated and easily removed after a few hours exposure. Clipping is not recommended as a procedure for the average patient to attempt.

The care of the scrub brush has intrigued some observers for the reason that spores of these fungi are not killed by drying, boiling, or antiseptics. Thorough washing after using and placing in the sun to dry is considered all that is needed as brush care. If the spores are resistant to ordinary means of eradication, although it leaves a weak point in the technic, it is not feasible to burden the patient with a step in the routine which is known to be futile.

The ulcerative type previously mentioned deserves special consideration. They are most frequently complications of foot mycosis. Most observers of fungus infection assign a prominent rôle to pyogenic organisms as a disturbing element in treatment of all fungus infections. Well-marked lymphangitis is a usual sequela and necessitates rest of the part. Hot applications of sodium hyposulphite, magnesium sulphate, or by personal choice, potassium permanganate are indicated. The fungus must be actively combated at the same time; therefore Deeks' ointment is used at night. It is believed that ulcerations result from injudicious treatment with irritant drugs and the pyogenic invaders are not the exciting cause of the persistent ulcer. Much experience during the past 10 years with fungus infec-

tion has left the impression that secondary infection is an inconsequential factor in treatment.

Crural and axillary infections should be treated less drastically, but none the less thoroughly. One or two applications of Deeks' ointment may be used. Calamine lotion with or without olive oil relieves pruritis and exerts some curative function.

At the onset this procedure is worthy of trial:

(a) Apply phenol solution in 3 per cent strength by cotton pledgets over the entire area.

(b) After solution No. 1 has dried apply formaldehyde 5 per cent strength of the United States Pharmacopœia solution liberally.

These applications may be made twice or thrice daily for two or three days.

Röntgen ray in small doses and ultra-violet ray are capable of producing remarkable results in resistant cases.

Heliotherapy is always of value in conjunction with other treatment. Exposure of the parts over a long period may cure the condition, if the patient's time is unlimited. It is believed that aërotherapy and heliotherapy combined served the deck force on board ship a good turn in that a lower incidence of fungus infection of the feet is found among them due to working on deck barefoot. Statistics are not available to confirm the assertion. Salt water is regarded as beneficial. However, "dhobie itch" is prevalent among sea bathers in every locality coming under my observation.

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POST-TONSILLECTOMY PAIN

By F. E. Locy, Lieutenant Commander, Medical Corps, United States Navy

Post-tonsillectomy pain slows the convalescence of the patient. It interferes with his rest and frequently prevents him from maintaining his strength due to difficulty in taking nourishment. It is influenced by three important factors. First, by the skill of the operator; second, by the presence or absence of virulent organisms in the throat, and third, by postoperative treatment. Dysphagia is the usual condition but frequently patients have a more or less continuous pain or ache at the site of the operation or on turning the head. Earache and generalized pains incident to setting free of toxins during the operation are not uncommon. The sensory nerve supply to the upper pole of the tonsil is from the posterior and middle branches of the posterior palatine nerve and that to the lower pole is from several branches of the glossopharyngeal. Earache following tonsillectomy is a referred pain due to stimuli passing along nerve fibers going through Meckel's ganglion.

Pain following the removal of tonsils is usually in proportion to the amount of operative trauma to the surrounding tissues. Laceration of the palatoglossus muscle in the anterior pillar seems to cause less pain and dysphagia than injuries to the palatopharyngeus muscle which forms the body of the posterior pillar. When the thin fibrous lining of the tonsillar fossa is ruptured during the operation there is frequently considerable infiltration of the tissues of the throat with marked local pain and stiffness of the neck. As elsewhere in the body, rough handling of the tissues causes more postoperative pain, slower healing and more liability to infection than if the tissues are handled with all possible gentleness. Too strong traction on the tonsil, too strong pressure on the surrounding tissues in certain types of removal, too strenuous use of the pillar retractor and too much force used in wiping out the tonsillar fossæ with gauze tampons all cause unnecessary pain. The routine use of strong styptic solutions, such as Monsel's and tincture of ferric chloride cause the patient unnecessary pain and but slightly lessen the possibility of hemorrhage.

When local anesthesia is used and excessive amounts of novocaine or other solution are injected there is caused some tearing of the tissues and œdema, which in itself causes distinct pain afterward. This is easily demonstrated by injecting the throat as for tonsillectomy and then not going further with the operation.

When operating in the presence of an acute infection of the nose or throat, virulent organisms frequently attack the denuded area, causing marked inflammation with its attendant swelling of the soft

parts, pain, and dysphagia. In some cases there may be virulent organisms lying dormant in the tonsillar crypts or walled off in a small tonsillar abscess. These may be set free during the operation and set up an unusual inflammatory process.

In the prevention of post-tonsillectomy pain, as far as the operation itself is concerned, the tonsils should be removed rapidly, entirely, and with the least possible trauma to the surrounding tissues. If the upper portion of the free edge of the posterior pillar is left covered with mucous membrane, the raw surface over which food must pass is reduced. The importance of complete removal of infected tonsil tissue can not be overemphasized. Rhoads and Dick (1) have recently found that a rather high percentage of patients who have had tonsillectomy (73 per cent of their series) still had fairly large pieces of tonsil tissue remaining. Frequently the purpose for which the tonsils were removed is defeated by the infection remaining in these fragments. They further believe that there seems to be some indication that the condition resulting from incomplete tonsillectomy is worse than that existing before the operation. When using local anesthesia, care should be taken not to inject the solution into the pillars but at the junction of the tonsil and the surrounding tissue. Soft cotton tampons may be rapidly changed in size by the operator during the operation and cause less trauma than gauze.

The customs of keeping patients in naval hospitals until recovery is complete affords an unusual opportunity to study postoperative care in these cases. As to postoperative measures which lessen the pain and dysphagia, the following have been found satisfactory: Quiet before, during, and after the operation is conducive to uneventful recoveries. A hypodermic injection of morphine sulphate grains ($\frac{1}{8}$) with atropine sulphate grains ($\frac{1}{100}$) given about 15 minutes before going to the operating room usually lessens the sensibilities of the patient and diminishes the amount of saliva. The patient should be placed after the operation in a darkened room or ward which is quiet and well ventilated. The patient should be kept here for 24 hours and then be allowed up in the absence of untoward symptoms. Three hours after the operation a glass of milk may be given and from that time on during the first day liquids may be given freely in small amounts. The day after the operation the diet should be increased by the addition of soft items of diet such as milk toast, Cream of Wheat, farina, soups, soft boiled eggs, and mashed vegetables. Some patients find that the juice of a sweet orange furnishes a measure of relief from the tenacious saliva that is so annoying to most of these cases. The tonsillar fossæ are kept clear of clots and œdematous uvulæ are clipped. Gargles and ice sucking have not been found to be of relief

to the patient or to hasten the convalescence, but an ice collar to the neck on the day of operation is a comfort to many.

Since the introduction of aspirin by Dresser in 1899 it has found many uses, not the least of which is its analgesic action in the throat. Its use has been mentioned in several books on therapeutics and in 1921 Heller (2) published an article on the use of aspirin in 1,000 tonsillectomy cases. He advocated that 1 to 3 decigrams of the dry powder be placed on the tongue or 3 decigrams of the dry powder to one quarter glass of water as a gargle. He stated that the aspirin made an acid solution with the saliva which acted as a vaso-constrictor and increased the muscle tonus of the damaged tissues of the pharynx. Harkness and Rock (3) in 1923 received 1,000 answers to questionnaires sent out on the subject of tonsillectomy cases and published an article on postoperative comfort in tonsil cases. The majority advocated morphine sulphate grains ($\frac{1}{4}$) before operation in adults, local anesthesia in preference to general anesthesia, injection of the anestheticizing solution at the line of cleavage between the tonsil and its bed; also cold after the operation in the form of ice bags to the throat and eating ice or ice cream. A smaller portion of the reporting physicians used aspirin in some form as a postoperative analgesic locally in the throat. Stevenson (4) in 1925 recommended that 10 grains of aspirin be floated on a half glass of water and that the patient be instructed to take some of this in the mouth and then roll the head from side to side so that some of the dry floating powder would be deposited on the throat.

Aspirin or acetylsalicylic acid in its dry powdered form blown gently and sparingly over the tonsillar fossæ has a remarkable analgesic effect. By experiment on over 2,000 cases it has been found that aspirin applied in this way is much more effective than when administered by any other method. In 5 to 15 minutes after its use in this manner practically all of the dysphagia disappears in most cases and the patient may eat in relative comfort. Very rarely will a patient say that it has no pain-relieving effect. As the first effect of aspirin in these cases is that of a burning sensation, some experiments were made with the use of a small amount of pulverized menthol added to the powdered aspirin. Menthol itself has a mild antiseptic and anesthetic action and in the throat produces almost immediately a cool sensation. Tannic acid was later added to the formula to provide an astringent element and for its effect in reducing the amount of salivary secretion. The following formula was arrived at by conducting a series of experiments to determine the most effective formula:

Rx	Acetylsalicylic acid.....	30.000
	Menthol, powdered.....	.100
	Tannic acid.....	.300

As with most other effective medicinal preparations, overuse and wrong application has its bad results. Care should be taken that the patient does not inhale any of the powder, as this sets up an unpleasant coughing. If the throat is sprayed too frequently this powder will be found to have an irritating effect. It should be applied about 15 minutes before each meal and once between meals, if necessary, for pain. Occasionally this powder has an irritating effect. This may be due to an idiosyncrasy of the patient or to an impure acetylsalicylic acid containing salicylic acid. After a few days, if the slough in the tonsillar fossæ becomes rather thick, these cavities should be washed out with warm normal saline solution. The analgesic powder may then be applied directly to the underlying granulations with better effect.

Too often post-tonsillectomy pain in uncomplicated cases is taken as a matter of course. The physician who can lessen it, and thereby allow his patients to rest and take nourishment, will shorten their convalescent period, lessen their complications, and usually gain their appreciation.

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THE USE OF LIPIODOL IN MAXILLARY SINUS DIAGNOSIS¹—A PRELIMINARY REPORT

A PRELIMINARY REPORT

By G. B. TRIBLE, M. D., F. A. C. S., Former Commander, Medical Corps, United States Navy, and M. I. BIERMAN, B. S., M. D.

INTRODUCTION

Simple radiography of the paranasal sinuses has very distinct limitations. No matter how clear the radiograph may be, one can not distinguish the various types of densities appearing in the sinuses. For instance, pus with thickened membrane, simple old thickened membrane, osteomyelitis of the sinus walls or granulations, all give approximately the same radiographic density. An old, healed sinus infection, with resultant thickened membrane or bone changes, will give exactly the same X-ray picture as a recent, active infection.

¹ Read before the eye, ear, nose, and throat section of the District of Columbia Medical Society, November, 1928.

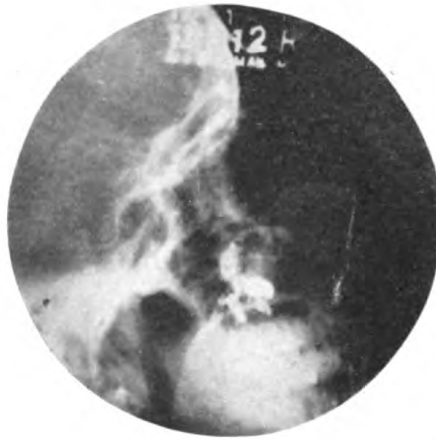


LIPIODOL MASS SHOWS CRESCENTIC LOWER MARGIN, AND APPEARS SUSPENDED WITHIN THE SINUS, CYST, OR POLYP. (TRIBLE AND BIERMAN)



LIPIODOL MASS SHOWS CRESCENTIC LOWER MARGIN, AND APPEARS SUSPENDED WITHIN THE SINUS, CYST, OR POLYP. (TRIBLE AND BIERMAN)

306-1



NARROW IRREGULAR LIPIODOL
SHADOW. SINUS PRACTICALLY
FILLED WITH GRANULATIONS AND
POLYPS. (TRIBLE AND BIERMAN)



NARROW IRREGULAR LIPIODOL
SHADOW. SINUS PRACTICALLY
FILLED WITH GRANULATIONS AND
POLYPS. (TRIBLE AND BIERMAN)

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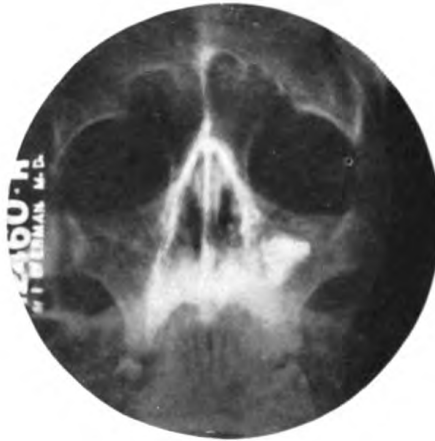


SINUS WELL FILLED WITH LIPIODOL
EXCEPT SUPERO-LATERAL AND
INFERO-LATERAL ANGLES. GRAN-
ULATIONS OR POLYPS. (TRIBLE
AND BIERMAN)



SINUS WELL FILLED WITH LIPIODOL,
EXCEPT SUPERO-LATERAL AND
INFERO-LATERAL ANGLES. GRAN-
ULATIONS OR POLYPS. TRIBLE
AND BIERMAN)

306—3



LIPIODOL OCCUPIES ONLY SMALL
PORTION OF SINUS AREA AND
SHOWS SLIGHTLY IRREGULAR
MARGINS. THICKENED MEM-
BRANE. (TRIBLE AND BIERMAN)



LIPIODOL OCCUPIES ONLY SMALL
PORTION OF SINUS AREA AND
SHOWS SLIGHTLY IRREGULAR
MARGINS. THICKENED MEM-
BRANE. (TRIBLE AND BIERMAN)



SINUS WELL FILLED WITH LIPIODOL.
MARGIN OF LIPIODOL CLOSELY
APPROXIMATES SINUS WALL; NOR-
MAL SINUS. (TRIBLE AND BIER-
MAN)



SINUS WELL FILLED WITH LIPIODOL,
BUT NARROW MARGIN BETWEEN
LIPIODOL AND SINUS WALL.
SLIGHTLY THICKENED MEM-
BRANE. (TRIBLE AND BIERMAN)

To overcome this limitation in diagnosis, various methods have been tried. The one that appeared to promise the most benefit was the injection of lipiodol. Historically, the making of Röntgen-opaque injections in the sinuses as an aid to diagnosis is not new. Its application is but an extension of the principles used in investigation of other tissues. Fraser reviews this subject at length in his paper, "Opaque Injection and Suffusion (Iodized Oil) in Oto-Rhinologic Diagnosis," read by invitation, February 28, 1927, before the Austrian Otological Society. In it he gives Moritz Weil credit for the first use of contrast substances. Weil believed an aqueous mixture of lead sulphate best suited and introduced it by cannula through the natural ostia. In a limited way this was used by several others, but it was not until 1924 that Brunetti and Filippini published their comprehensive paper. They first used 15 per cent potassium iodide; later barium sulphate in an aqueous solution of acacia. Up to this time extensive time-consuming methods were employed and care taken to remove the solution after radiograph.

The present era may be dated back to the introduction of iodized oil in X-ray work, and its frequent use in mapping out the bronchi. Reverchon and Worms applied lipiodol in study of the Eustachian tube and to the maxillary sinus, and in 1925 it was used by Fraser, who extended this field to the frontal and sphenoidal. He made use of a series of very ingenious instruments, but Proetz filled the sinuses by the insufflation method alone and appears to have been fairly successful. We tried it a few times, were unsuccessful, and so abandoned the method. The results with insufflation were found to be unreliable in our hands.

About a year and a half ago, we felt that inasmuch as the antrum was being punctured many times daily for both diagnostic and therapeutic purposes, it would be very simple to drop some lipiodol into the antrum and follow by immediate radiography. This was not followed by immediate success. For several reasons, at first no lipiodol shadow was obtained, or only a very poor shadow. After the first few cases, however, the lipiodol shadows were excellent. In cases without disease, the lipiodol entirely filled the sinus. In pathological conditions the lipiodol filled the remaining sinus space.

TECHNIC OF INTRODUCTION

The method of introduction of the lipiodol used at present is as follows:

Cocainize the subinferior turbinate area of the nasal-antral wall; cleanse the nose by mild saline or soda bicarbonate irrigation, and using a straight Lichwitz needle, puncture the antrum, attach the tube to the needle, aspirate to determine if in the sinus, and to see if

any secretion comes into the needle spontaneously. Then irrigate through the needle with gentle pressure, using the large Asepto syringe and sterile, normal saline or soda bicarbonate solution, catching the wash water in a large basin and permitting it to stand and the solid contents to settle for later examination. So far the steps are the same as the puncture for diagnosis or treatment, but instead of injecting mercurochrome, or other antiseptic, the fluid is aspirated so far as possible, air blown through the tube to dry out the cavity, and a Record syringe is filled with about 5 to 8 cubic centimeters of lipiodol (33 per cent in either liquid petrolatum or olive oil), and slowly injected through the needle, still in position. Here an error may come in; the solution may all run out through the accessory ostia, and if this proves to be the case, in the next injection a small pledget of cotton is placed under the inferior turbinate and one under the middle turbinate.

When the first cases failed to show any lipiodol shadow, numerous conjectures were made: That the solution was not röntgen-opaque; that the needle was not in the antrum. If the needle had not been in the antrum the solution would still have shown up, no matter where it was. If the solution had not been röntgen-opaque the other cases using the same solution would not have shown it.

The patient is then radiographed immediately. First a lateral view is taken, with the injected side down (that is, nearest the film). This is to prevent running out of the solution through the natural ostium. As true a lateral radiograph as possible is made. Next a radiograph is made in the "Waters" (chin-nose) position. Occasionally stereoscopic pairs are made in this position when for some reason especial study is to be given. The films are developed immediately, and if any question arises more are immediately made. In our practice it is customary to make an immediate "wet-film" interpretation for a working diagnosis, with the complete report following the next day.

FISTULAS

Introduction through dental or other fistulas may be made and is of great value in such cases. The pathology will be along the floor and a puncture through the intact wall will not be necessary.

FLUOROSCOPIC EXAMINATION

This is not made as a routine and is not as satisfactory as films. It is of value in certain cases, showing unusual features. The presence of pockets, of large cysts, polyps, or growths, or of interference with the entry of the lipiodol can be shown up. A partial filling

may be made and changes in level studied under the fluoroscope, or the introduction itself may be done under fluoroscope and any irregularity in filling observed.

INTERPRETATION

As would be expected, the lipiodol fills only the sinus space. Any portion of the sinus area which has been encroached upon by adventitious tissue will show as a defect in the lipiodol shadow the filling defect. Depending upon the shape, size, position, and distribution of the lipiodol shadow and its defects, a radiographic interpretation is made.

When the lipiodol shadow closely follows the sinus walls, no pathology of the lining membranes is present. When the lipiodol opacity is only a small, crescentic shadow occupying the upper portion of the sinus, as if suspended in the air, it is lying upon a rounded mass. The mass is then either a cyst or a polyp. When the lipiodol shadow is very small, and occupies only a small portion of the sinus, a greatly thickened membrane is present. The pyogenic or hyperplastic membrane is so thickened as to occupy a great portion of the space which should be occupied by the lipiodol. When the lipiodol is distributed in a few small, irregular masses, the sinus space has been irregularly encroached upon. This usually indicates granulations or polyps. When no lipiodol will enter the sinus, the sinus is completely filled by adventitious tissue. After a series of treatments, lipiodol can again be injected and notation made of the condition shown.

CONTRAINDICATION

Not indicated in acute cases, or in any case when puncture is contraindicated.

SUMMARY

A study of another method in maxillary sinus diagnosis has been presented which has particular value in determining, first, the existing state of the sinus; second, its progress under treatment; and third, a guide to those least apt to recover by simple measures and in which operative procedures are necessary.

The technic of introduction of the oil requires no methods not now used by rhinologists, nor instruments not in daily use.

Accuracy of diagnosis has been considerably advanced, for radiograph alone can not differentiate; and irrigation can be negative, yet opening the antrum shows thick, water-soluble secretion. It may even come through the cannula, that is, pus by aspiration, then nothing in irrigation. Operative findings with tissue reports have shown that the character of the pathology encountered bears out the interpretations indicated.

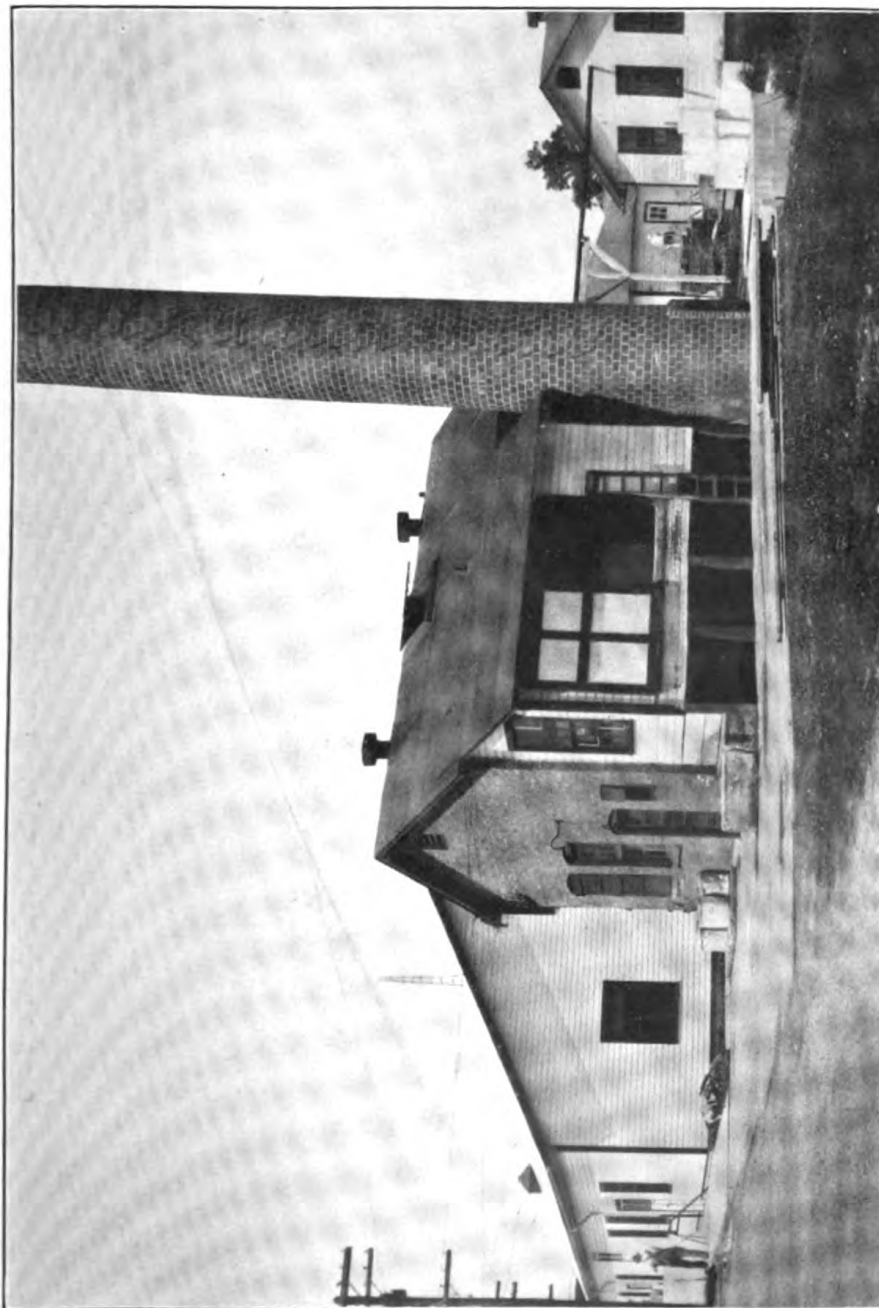
DISPOSAL OF HOSPITAL GARBAGE AND TRASH

By A. FARENHOLT, Captain, Medical Corps, United States Navy

Garbage, which necessarily accumulates in the galleys of our naval hospitals, has a certain money value; however, except under infrequent circumstances, it is seldom possible to realize it. To utilize our food wastes through the maintenance of a hospital farm, is not considered advisable and to sell it necessitates a lengthy procedure through the supply department, complicated by uncertainty of collection, a probability of faulty methods, and difficult segregation of refuse, such as isolation of broken glass, drugs; for instance, bichloride tablets, coffee grounds, etc.

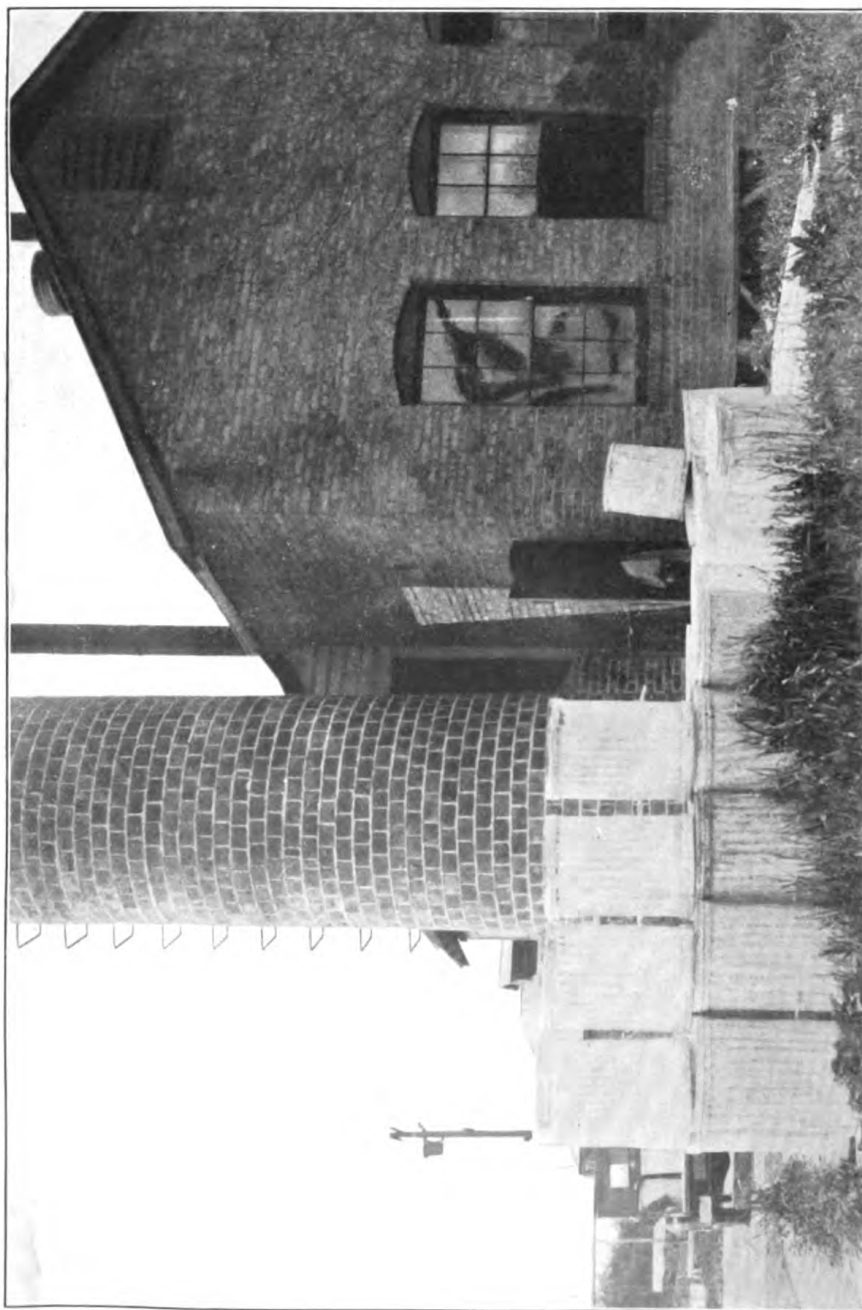
It will usually be found more satisfactory to dispose of these wastes by incineration within the station confines. Almost every hospital, has an incinerator, although the plan and capacity vary greatly. The small home-made pattern, such as described in the Bulletin, volume 7, No. 4, 1913, will suffice for a small station, while, of course, the larger contract-built plant will be required at a large hospital. The hospital at Great Lakes is fortunate to possess a very satisfactory incinerating plant built in 1923, and housed in a brick building 22 feet by 28 feet. This size permits of special arrangements in the handling of collection cans, which have proved to be eminently satisfactory and which may be of interest to other institutions.

The open gate-sided truck, used for the collection of refuse cans both from the galleys and from the houses of resident families, backs up to a platform built to the height of the floor of the car. These cans are easily unloaded and the contents immediately scraped and dumped into the entrance chute and thus directly into the fire, kept to the proper point by wooden trash which also must be disposed of. The emptied can is at once passed down to the ground-floor level. Here are two wooden tanks, each 8 feet long, 30 inches wide, and 30 inches deep, and each arranged with steam pipes at the bottom which allow the aqueous contents to be heated to just below the boiling point. Tank No. 1 contains a solution of lye, two cans being added each day, which strength is sufficient to cut the grease and cleanse the cans. This receptacle is emptied and cleaned out once each week. Tank No. 2 is called the "white-wash" tank. A 50-pound sack of lime is added once each week and the contents are drained and renewed once each month. The emptied garbage can is first thoroughly washed in tank No. 1, then removed by hooks, drained, and immersed in tank No. 2 for a few minutes. The can is then removed and placed on the drying platform, where it assumes



INCINERATOR PLANT, NAVAL HOSPITAL, GREAT LAKES, ILL. (FARENHOLT)

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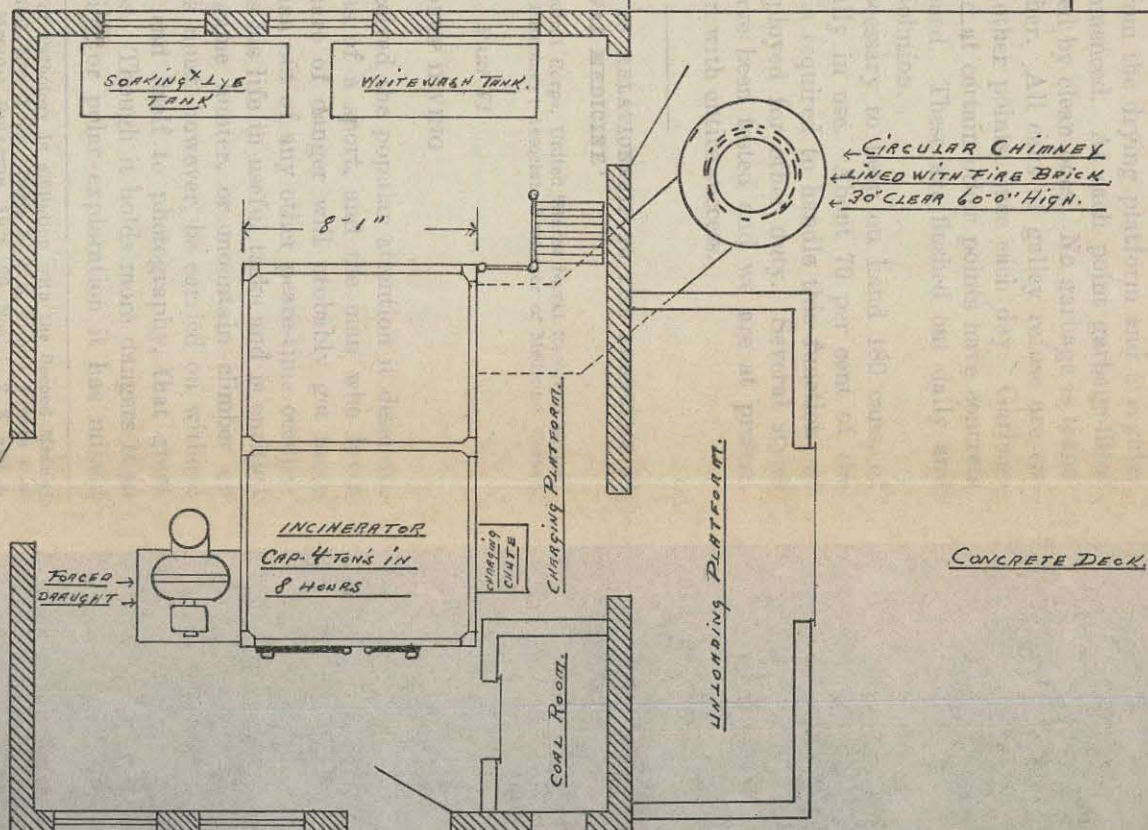
CANS DRYING PRIOR TO COLLECTION AND DISTRIBUTION. (FARENHOLT)

310-2

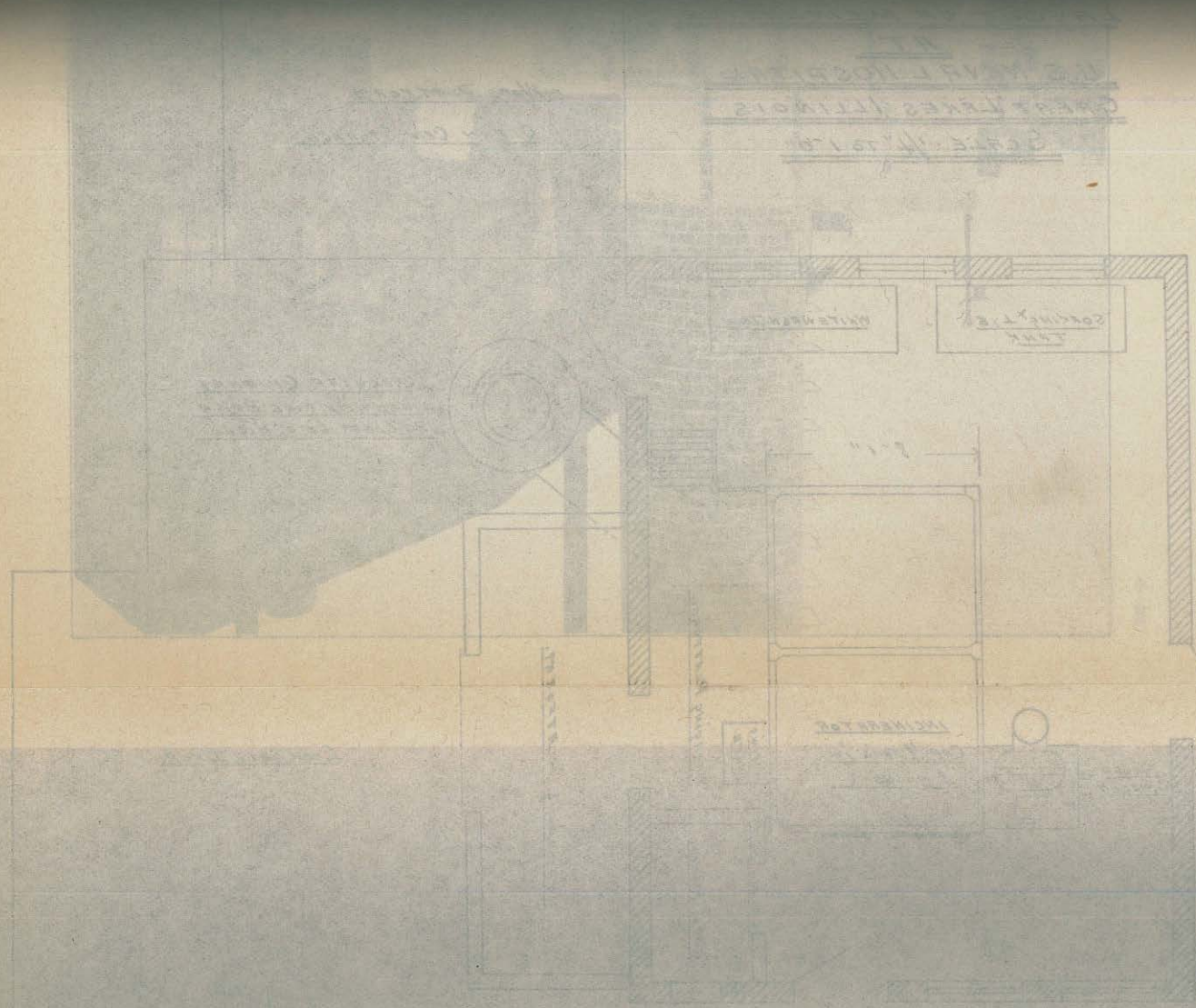
LAYOUT OF INCINERATOR
AT
U.S. NAVAL HOSPITAL
GREAT LAKES ILLINOIS
SCALE - 1/4" TO 1'-0"

WOOD PLATFORM

CLEAN OIL STORAGE



CONCRETE DECK.



a pleasing, clean, white appearance. From here it is taken up by the garbage truck.

Two men are employed in this incinerator, as there is quite an amount of work necessary in breaking up boxes, trash, etc., keeping the fires in proper condition, and dumping and cleaning cans. Two men are assigned to the garbage truck and the following routine is carried out daily except on Sundays and holidays. A load of about 24 clean cans is picked up from the drying platform and a regular route about the grounds commenced. At each point garbage-filled cans are taken up and replaced by clean ones. No garbage is transferred from one can to another. All cans of galley refuse are exchanged twice each day; at other points, once each day. Garbage houses at the main galley and at certain other points have concrete floors, are drained and screened. These are flushed out daily and sprayed with a fly-repelling solution.

For our purposes it is necessary to keep on hand 180 cans, of which number 120 are actually in use. About 70 per cent of the time of the truck and crew is required to handle this function; at other times the truck is employed for other duty. Several styles and makes of receptacles have been tested and we are at present using a Witt's No. 2 fluted can with entire success.

PHYSIOLOGY OF RESPIRATION IN RELATIONSHIP TO THE PROBLEMS OF NAVAL MEDICINE¹

By EUGENE F. Du BOIS, Captain, Medical Corps, United States Naval Reserve; Medical Director, Russell Sage Institute of Pathology; Associate Professor of Medicine, Cornell University Medical College

PART VI

DEEP DIVING

Deep diving has never received the popular attention it deserves. It has many of the elements of a sport, and the man who loves adventure with a goodly share of danger will probably get more thrills out of deep diving than out of any other peace-time occupation. The expert diver risks his life in useful tasks and is entitled to more honor than a big-game hunter, or mountain climber or boxing champion. His work must, however, be carried on without spectators, and it does not lend itself to photography, that great stimulant of modern prowess. Though it holds more dangers than aviation or mountain climbing or polar exploration it has missed

¹ From the Russell Sage Institute of Pathology in affiliation with the Second Medical (Cornell) Division of Bellevue Hospital, New York. Parts 1, 2, 3, 4, and 5 were published in the UNITED STATES NAVAL MEDICAL BULLETIN, 1928, 26, Nos. 1, 2, 3, and 4, and 1929, 27, No. 1.

the popular appeal and the news value that has done so much to forward the other sports. If deep-diving contests were only included in the Olympic games we would have new records every few years. Of course there will never be Olympic contests, but a great deal can be done by friendly contests in our own Navy. It is to be hoped that more of our line and medical officers will take interest in diving as a sport and not leave the dangers and honors to the noncommissioned officers. There are always a few commissioned officers who do not hesitate to go down to considerable depths, but most of the names that stand out in the annals of deep diving are those of gunners.

Deep diving has a long and honorable history and there are a good many references to the subject by such ancient writers as Aristotle, Pliny, and Julius Cæsar. Shortly after the discovery of America there was renewed interest in diving and various forms of crude apparatus were invented. The curious name of "*ars urinatoria*" was given to this science, probably derived from the bladders filled with air that were used by some divers. Diving bells of simple design were used until Halley in 1717 attached to the bell a tube with air pumps, but these pumps were so weak that they could not be used for depths over 3 fathoms. For greater depths he let down air in weighted barrels. Many forms of diving suits were suggested in the seventeenth and eighteenth centuries, but nothing practical developed until Siebe invented his open dress in 1819 and his close dress in 1837.

The first important work on the physiology of diving was that of Boyle in 1670. He experimented on animals under different air pressures and demonstrated the presence of gases in the blood. Hoppe-Seyler in 1857 was the first to prove that bubbles of gas in the blood were the cause of death after the rapid decompression of animals. The work was carried further by Paul Bert (2) who placed on a firm foundation our present knowledge of the effects of variations in barometric pressure.

Leonard Hill (3) in his standard work on Caisson Sickness, published in 1912, has given a most entertaining review of the history of deep diving. Even more complete is the monumental compilation of Heller, Mager, and von Schrötter (4) who in 1900 published two large volumes on this same subject. The Viennese writers have devoted 354 pages to a review of the development of deep diving, ballooning, mountain climbing, and caisson work and have reproduced many excellent pictures of old apparatus. Their own work consisted of a careful study of caisson disease developed at Nussdorf, near Vienna, during the construction of a large canal. They also performed many experiments on animals, and their illustrations of the pathological specimens are particularly good.

In Part 1 (1) of this present series of papers on respiration a brief review of certain laws of physics was given because they applied to all of the problems discussed. Some of these laws are particularly important in deep diving. We must remember that when we are at sea level we are always under a pressure of 760 millimeters of mercury (about 30 inches), and that each square inch of skin is subject to the pressure of about 15 pounds, to be exact 14.7 pounds. Of course, the inside of the body has exactly the same pressure as the outside in just the same manner as the inside of a sponge submerged in water has the same pressure as the outside of the sponge. If a man had a vacuum inside of his body the total pressure on the outside would be enormous, corresponding roughly to that which would be exerted on a man if he were made to lie down in the bottom of a large box which was then filled with iron crowbars standing vertically, the butt of each crowbar resting on the man's skin. In the horrible accident of "squeeze" which occurs when the air pressure inside of a diver's helmet is less than that of the water outside this pressure effect is actually exerted with fatal results. Ordinarily the air pressure inside the helmet is a little greater than that of the surrounding water and the diver hardly notices any sense of pressure, no matter how great the depth. Man can adapt himself rapidly to great changes in outside pressure. The writer once had the opportunity of being a passenger in an altitude flight to the height of 23,200 feet where the barometer showed 325 millimeters or 42 per cent of an atmosphere. The next day in a diving suit he was under the pressure of 189 feet of water, 5,114.8 millimeters mercury or 6.73 atmospheres, absolute. Thus, the greatest pressure was more than 15 times the lowest pressure but there was no discomfort at either extreme.

In all calculations we must remember the difference between gauge pressure and absolute pressure. The ordinary pressure gauge registers 0 in the open air when the absolute pressure is 760 millimeters Hg, or 14.7 pounds to the square inch. When one additional atmosphere of pressure is added the gauge will read 1 atmosphere, or roughly, 15 pounds, but the absolute pressure will be 30 pounds. In all physical and physiological calculations we should use the absolute pressure. If we multiply the absolute pressure in millimeters Hg by the percentage of each gas present in the air we obtain the true partial pressure of each gas and we must think in terms of partial pressures. The physiological actions of gases are strictly conditioned by their partial pressures. Thus, 10 per cent of oxygen at 30 pounds pressure, absolute (15 pounds gauge pressure), has the same physiological effect as 20 per cent oxygen at 15 pounds pressure, absolute (0 pounds, gauge).

It is for this reason that we have no difficulty in supplying the diver with plenty of oxygen. At a depth of 132 feet of sea water, an absolute pressure of 5 atmospheres, the man could live comfortably with a mixture containing 4 per cent oxygen. Oxygen, the good gas, is concentrated at great depths, but unfortunately nitrogen, the inert gas, and carbon dioxide, the harmful gas, are concentrated also. Thus, a man can breathe a mixture containing 1 per cent carbon dioxide at sea level without any noticeable effects but if this percentage were present in his helmet at a depth of 5 atmospheres, absolute, he would almost suffocate. Nitrogen, the gas which causes the bends, goes into solution in the blood and tissues according to its partial pressure. If a man remains a sufficient length of time at a pressure of 5 atmospheres, absolute, his blood and tissues will contain five times as much nitrogen as at sea level. If he returns to sea level too suddenly the tissues are caught with more nitrogen than they can hold and therefore bubbles of nitrogen are liberated in the most inconvenient places.

THE NAKED DIVER

Heller, Mager, and von Schrötter (4) have reproduced travelers' accounts of deep diving in many lands. According to one report there were as many as 600 pearl divers in the region of Panama in the year 1587. The customs of natives who go down to great depths for pearl oysters and sponges differ only slightly in various parts of the world. The divers take several deep breaths and then descend rapidly, usually carrying a weight attached to a rope. After a short period of activity at the bottom they swim to the surface or else are pulled up as quickly as possible. Sometimes they come to the surface almost unconscious and most of the travelers speak of many cases of bleeding from the nose, mouth, and ears. The usual effects can not be very serious as the divers go down many times in the same day. Reports differ as to the maximum depths attained and as to the length of stay under water. There are stories of dives to depths of 100 to 150 feet and even more. Von Schrötter considers the period of $2\frac{1}{2}$ minutes is the longest possible for a man who has to work at a great depth. One particularly interesting account of divers in artesian wells in oases of the Sahara says that the divers bring up sand from a depth of 120 to 130 feet and remain under water 3 to 4 minutes. They are brought to the surface half suffocated and almost unconscious. In some places the divers put wax in their ears and some use nose clips.

Leonard Hill (3) has given an excellent description of the pressure effects in naked divers. On a descent to a depth of 100 feet the air in the mouth, nose, ears, and lungs is compressed to one-fourth of

its former volume. If the rigid middle ear and nasal cavities are not in free communication with the nonrigid cavities there will be a cupping effect with resulting hemorrhage. Every physician knows that ordinary cupping glasses with a reduction of pressure much less than one atmosphere can produce ecchymoses even when applied to the tough skin of the back. If the Eustachian tubes and openings into the nasal sinuses are patent there will be no such cupping effect and the rise of the diaphragm will take care of the compression of the lungs. This can be best understood by help of Figure 3 in Part 1 (continued) of this series of papers. (1) The diagram shows that after a maximal inspiration the total volume of air in the lungs will add up to about 6.5 liters. If this is compressed to one-fourth its volume, 1.6 liters, it will just about equal the amount of residual air present after the deepest possible expiration. During the whole period of the dive oxygen is being abstracted from the lungs but carbon dioxide is being excreted into them at approximately the same rate. Some nitrogen and oxygen are forced into the blood and tissues in physical solution but the quantities are probably not great since the stay at the bottom is scarcely one minute. Naked divers get the bends only if they make repeated dives.

Hill (3) has made a detailed study of the best type of deep breathing before a long dive. The increased ventilation washes a good deal of CO_2 out of the lungs and gives more room for fresh air with its additional oxygen. If, however, the process is carried too far, the CO_2 is washed out of the body tissues, producing the well-known acapnea effect described by Yandell Henderson. Hill says that massage and short preliminary runs help the circulation of the muscles, and he ascribes some of the benefit to an oxidation of the lactic acid in the muscles. Leonard Hill, together with Martin Flack, found that a few breaths of oxygen made it possible for a man to hold his breath much longer than if he merely takes a few breaths of air. Later they extended this administration of oxygen to athletes and obtained better performances than usual.

Hill and Flack found that most of their experimental subjects could hold the breath five to six minutes after breathing oxygen deeply for two to three minutes. One man held his breath nine minutes. The subjects could do much more work on one breath after breathing oxygen. In round figures most of the men could run about 100 yards on one breath after one full inspiration and about 150 yards after breathing air deeply for two minutes. After breathing oxygen deeply for two minutes most of them ran over 200 yards on one breath; one man ran 420 yards, but was dazed during the latter part of this extraordinary performance. The "breaking point," when a man is forced to take a breath, usually comes when the CO_2

in the alveolar air of the lungs has risen to 6 to 7 per cent and the oxygen has fallen to 9 to 10 per cent of an atmosphere. The work of Hill and of Vernon has shown that a higher concentration of CO_2 , on the average 1.7 per cent higher, can be stood when there is plenty of oxygen in the lungs.

Leonard Hill says that the most favorable result can be obtained by moderately deep abdominal breathing. In spite of less ventilation than might be obtained with thoracic plus abdominal breathing he says the breath can be held longer because the blood is circulated better during the period of deep breathing. He recommends that the diver should breathe deeply for two minutes and fill his lungs from a bag of oxygen just before diving. This sounds very logical in the light of his experimental work. I have not yet come across any reports of a trial of this method with trained native divers.

DIVING WITH OPEN HELMET

An open helmet can be used like a diving bell, and it seems to work quite satisfactorily in water that is not too cold and not too deep. A plentiful supply of air pumped into the helmet through a long hose escapes at the bottom of the helmet. The diver wears ordinary shoes and is not weighted, so that he is obliged to maintain his upright position during the descent and during his whole stay at the bottom. It is customary for the divers to throw off the helmet and swim to surface when their work is finished. This rapid method of escape is often a great factor of safety. One interesting example of this is described by Gunner Stillson (5) in his excellent report on deep-diving tests. Open-helmet diving is dangerous if there happens to be any small leak in the helmet. When the pumps are working freely the leak is not noticed, but if they stop for a short time the water rises in the helmet until it reaches the level of the nose and the man can not take a full breath before swimming to the surface. A helmet will, of course, fill with water immediately if the diver falls into a horizontal position. On the other hand, "squeeze" is impossible with an open helmet.

DIVING WITH HELMET AND SUIT

The standard apparatus for deep diving consists of a helmet with corselet clamped tightly on a suit of rubberized fabric. This suit covers the whole body with the exception of the hands. A water-tight joint is made at the wrists by means of strong rubber wristlets. These have a valvelike action and prevent the entrance of water but permit the exit of air if the suit becomes too distended. All that the diver has to do is to raise his arms above his head and the excess air will escape, thus preventing the danger of rupture of the suit. Air is

supplied to the helmet of the diver by means of a strong hose connected to air pumps, or better still to flasks of compressed air. One of the most vital parts of the helmet is the nonreturn valve at the end of the air hose. This prevents the return of air through the hose when the air pumps are stopped in order to read gauges or to permit the use of the telephone. If this valve does not function properly and if the pressure of air inside the helmet falls below that of the surrounding water the diver will suffer the frightful effects of "squeeze," the whole blood and even the tissues of the thorax being forced into the rigid helmet.

The large volume of air that must be supplied to the diver each minute escapes through a spring valve in the side of the helmet. There is also a supplementary air-escape valve on the front of the helmet, commonly called the spit cock. When compressed air from tanks is used a valve is provided near the diver's waist so that he can regulate the supply of air. The helmet and upper portions of the suit contain a good deal of air and the diver would float if he were not provided with lead weights around his waist and on his shoes. When he is fully dressed his equipment weighs about 180 pounds. In addition to the air hose the diver is connected to the surface by means of a life line which usually carries telephone wires. In order to get down to the bottom and find his way back to the boat at the surface he uses a "shot line" with a heavy weight. Attached to this weight which rests on the bottom is a "distance line" which keeps the diver from getting lost in the dim light. One important part of the equipment is the sheath knife which is sometimes employed as a last resort in cutting life line and even hose line when the diver is badly fouled at the bottom.

An experienced diver can regulate the flow of compressed air and the adjustment of the air-escape valve with such nicety that he feels no pressure in breathing, no uncomfortable weight from the helmet, and at the same time preserves just the right buoyancy. This is by no means easy for the beginner. The pressure effects have been well described by Haldane in the classical Admiralty Report on Deep Diving (6). I shall quote this report verbatim:

When a diver goes under water, any air with which his dress is inflated is driven out through the outlet valve by the pressure of the water, so that the dress becomes closely applied to his legs, body, and arms, up to the corselet. * * * If the valve were kept screwed up so far that the dress remained inflated under water he would not be able to get down. The consequence of the collapse of the dress is that the pressure on all parts of the body below the helmet is greater than in the helmet. If the valve is freely open, the excess of the pressure on any part of the body will be equal to that of a column of water the height of the valve outlet above this part. Thus the external pressure on the chest at the nipple will be about 1 foot of water, or 70 pounds per square foot, above the pressure in the helmet. As the pressure in the lungs is that of

the helmet, the diver will have to expand his lungs against this excess of pressure; and when the experiment is tried the exertion required is found to be very considerable, and breathing is greatly hampered.

In order to experience the effects of varying pressures in the helmet it is merely necessary to alter the height of the valve outlet. A nozzle was therefore substituted for the valve, and a rubber tube of 1 inch diameter and 2 feet long, with a valve on the end, attached to the nozzle. By varying the height of this valve, which was kept freely open, the effects of varying pressure in the helmet were observed by the diver (Doctor Haldane). If the valve was held a few inches above the helmet the excess of pressure on the chest and abdomen was so great that breathing was altogether impossible, owing to the very limited power of the inspiratory muscles. The experiment is a very unpleasant one, and probably not free from risk of hemorrhage from the lungs or air passage, or temporary stoppage of the heart. With the valve at the top of the helmet breathing was possible, but was extremely labored. With the valve at its ordinary level (about opposite the ear), breathing was still labored, the adverse pressure being specially felt during exertion, or with a short air supply. With the valve 2 or 3 inches lower, at the level of the upper part of the breast-plate, breathing was much easier. At this height of the valve the helmet and attached weights are just lifted off the shoulders, and the marked relief experienced is probably due largely to the fact that the diver has no longer to inspire from what is practically a small air space with rigid walls. The smallness of this space makes it impossible for him to inspire freely, except during the actual inblow from each stroke of the pump. With the valve still lower the helmet is lifted right off the shoulders, and so much air accumulates in the dress that the diver begins to lose his hold on the ground.

Under ordinary conditions an experienced diver adjusts the pressure on his valve in such a way as to ease his breathing as far as possible without endangering his stability, and he may frequently have to adjust the pressure on the valve as he changes the position of his head. If, with the valve comfortably adjusted for the erect position, he stoops down for more than a short time, air accumulates in his dress, and he runs the risk of being "blown up" (i. e., carried to the surface)—a dangerous accident if he is at a considerable depth. In order to stoop or crawl on the bottom he must unscrew his valve, so as to let air escape freely. If his head is nearly as low as his body, as when he is lying or crawling on the bottom, he can, however, breathe quite comfortably with the valve freely open, since the excess of pressure on the chest and abdomen is greatly diminished. This position is the most easy one for a diver.

Haldane and the other members of this committee which made its report in 1907 went on to study the cause of the difficulty in breathing encountered by divers at great depths. They reasoned that it was not the mechanical effect of pressure because men in the greatly compressed air of deep caissons can work just as easily, if not more easily, than at the surface. They suspected that an excess of CO_2 was the cause of the trouble and proved it by actual analysis of the air in the helmet. We have already shown that it is the partial pressure of a gas and not its percentage that is significant physiologically. Haldane and Priestley and Greenwood and L. Hill (3) have shown that the partial pressure of CO_2 in the alveolar air is constant at different atmospheric pressures.

In one series of experiments the subject, M. G., showed in his alveolar air the following percentages of CO_2 : At sea-level (1 atmosphere) 5.4 per cent, at 2 atmospheres (absolute) 2.7 per cent, at 3 atmospheres 1.8 per cent, at 5 atmospheres 1 per cent, and at 6 atmospheres 0.9 per cent. It will be noted that the percentage of the gas multiplied by the atmospheres of pressure gave almost exactly the same results under all of these pressures. If a man were at a depth corresponding to 6 atmospheres and the CO_2 in his helmet could not be kept below 0.9 per cent it would correspond in its composition to the air at the bottom of the lungs and he would be in great distress. The helmet really constitutes a large dead-air space, contaminated by the expired air and this must be scavenged out by a liberal supply of air, much greater than would be necessary if a mouthpiece with inspiratory and expiratory valves were employed. In the previous paper of this series we have spoken of the serious disadvantage of a helmet attachment to a mine-rescue apparatus where the air supply is strictly limited. In the case of the diver a helmet is required to give the necessary freedom of the head and to make the use of the telephone possible. Therefore in order to use the helmet successfully the supply of air must be increased in proportion to the depth. The Admiralty committee (6) enunciated the law that "whatever the pressure a diver is under, he requires the same volume of air, measured at that pressure." Thus a man at a depth of 165 feet (6 atmospheres absolute) will need six times as great a volume of air measured at the surface as he requires at the surface level. The committee discovered that adequate amounts of air were not being delivered by the pumps in 1907 because they developed leaks when working at high pressures.

When they remedied these leaks and improved the pumps the divers were able to work without discomfort at considerable depths. They determined the actual CO_2 production of divers under all sorts of different conditions of pressure and activity. The experienced divers, Lieutenant Damant and Mr. Catto, produced while at rest at different depths from 0.013 to 0.022 cubic feet of CO_2 per minute, one of the low results being obtained at a depth of 210 feet. For ordinary fairly hard work the production was increased two or three fold, the highest figures of 0.079 cubic feet of CO_2 per minute being obtained when Mr. Catto was struggling to free himself from mud at a depth of 42 feet. The committee made out a table showing the volume of air to be supplied to men at various depths in order to keep the CO_2 down to a level equivalent to 3 per cent at the surface. Even this is not a very comfortable mixture in which to perform work, and they state that an ampler supply would be of advantage during hard labor.

The oxygen supply is always adequate and there is evidence to show that the increased partial pressure of this gas makes work easier in the case of men who are not in the best physical condition. The well-trained athlete or workman does not receive so much benefit from increased oxygen. We have already spoken about the work of Hill which shows that an increase of oxygen in the lungs allows the individual to tolerate somewhat larger amounts of CO_2 . Oxygen at too great a partial pressure can be actually poisonous. It is said that Lavoisier himself was the first to discover that pure oxygen could be poisonous, but it remained for his countryman, Paul Bert (2), to prove the fact by a careful series of experiments. An excellent review of the literature will be found in Leonard Hill's book (3).

Bert studied animals, mostly birds, under different pressures of air and of air with high percentages of oxygen. The toxic effects were proportional to the partial pressures of the oxygen (percentage of the gas multiplied by pressure) and also to the duration of the exposure. Thus animals made to breathe 2, 3, or 4 atmospheres of pure oxygen were in the same condition as those exposed to 10, 15, or 20 atmospheres of air. When air is compressed to a pressure of 10 atmospheres it contains, roughly, 20 by 10, or 200 per cent, of atmospheres of oxygen. Bert found that animals exposed to 300 to 400 per cent atmospheres of oxygen died rapidly. Prolonged exposure to one-fifth of this amount caused symptoms of illness. Rapid decompression from the higher pressures of concentrated oxygen caused convulsions on account of the liberation of bubbles of this gas in the tissues. At a pressure of 4 atmospheres of oxygen as much as 9 to 10 per cent would be in simple solution in the blood, in addition to the 20 per cent combined with hemoglobin. The work was carried further by Lorraine Smith, who discovered that the exposure of animals to a pressure of 170 to 180 per cent of an atmosphere of oxygen produces pneumonia. He found that mice exposed to an atmosphere of 40 per cent of oxygen for 8 days had no effect; 80 per cent for 4 days killed half of the mice; 180 per cent killed mice in 24 hours; and 300 per cent produced inflammation of the lungs in 5 hours. Smith's work was extended by Hill and also by Karsner. Hill does not believe that divers or caisson workers will suffer from oxygen poisoning until they descend to pressures of 10 to 15 atmospheres of air because the period of stay at great depths is usually of short duration. Nevertheless, Hill and Davis use a mixture containing only 50 per cent oxygen in their self-contained diving dress in order to prevent poisoning and they consider that this mixture is safe to breathe up to a depth of 70 to 100 feet for 30 to 60 minutes. If divers with the ordinary diving suit and hose attachment are to stay more than a very short time at depths over 300 feet it may

be necessary to supply them with air containing only one-half or one-quarter of the usual amount of oxygen. This can readily be accomplished by diluting the air in the compressed-air tanks with nitrogen or helium.

THE EFFECTS OF COMPRESSED NITROGEN

The chief limiting factor in deep diving and caisson work is the danger of caisson sickness, "the bends." It took a long time for physiologists to agree as to the cause of this striking disease, and the reader will find a very full account of the different theories in the large work of Heller, Mager, and von Schrötter (4). A shorter and more readable history is given by Leonard Hill (3). For a long time mechanical theories of pressure changes in different parts of the circulation held sway and were even promulgated by American physicians at the time of the building of the Brooklyn Bridge and the early days of the Hudson Tunnel. Hoppe-Seyler in 1857 is said to have been the first to prove the escape of bubbles of gas in the tissues on sudden decompression, but it remained for Paul Bert (2) to publish in 1878 a series of beautiful experiments showing that all of the manifestations of caisson sickness were due to the liberation of bubbles of nitrogen in the blood and tissues. His work has been extended and confirmed by Heller, Mager, and von Schrötter, Haldane, and Leonard Hill and their associates.

When the air surrounding a man is compressed, let us say to 4 atmospheres absolute, the whole body tends to come into a new gaseous equilibrium. The gases are soluble in water and in the body fluids in proportion to their partial pressures according to Dalton's law. It is assumed, perhaps incorrectly, that the blood in the pulmonary capillaries comes into immediate equilibrium with the air in the alveoli. At 4 atmospheres the plasma leaving the lungs would therefore hold four times as much nitrogen and oxygen as at 1 atmosphere pressure. There would be no change in the CO_2 because the partial pressure of CO_2 in the alveolar air is always maintained at about 5.6 per cent of 1 atmosphere at all pressures. It requires a considerable length of time for the fresh blood leaving the lungs with its increased oxygen and nitrogen content to bring the whole body up to the new level of saturation. The increase in oxygen is of some physiological importance because it makes tissue respiration a little easier, but it is the nitrogen that should engage our chief attention. Nitrogen at 37° C. has a coefficient of absorption of 0.97 in water and according to Hill the coefficient is a little less for blood. In round figures, the blood at sea level contains 1 per cent of nitrogen gas in solution and most of the tissues are supposed to be in equilibrium at this level. This is not true for

all tissues because oxygen and nitrogen are about five times as soluble in fat as in water. Vernon found that at 37° C. oxygen was four and five-tenths times as soluble in fat as in water, nitrogen five and three-tenths times as soluble.

It takes several hours before the blood can transport from the lungs enough nitrogen to saturate the whole body at the new pressure. Those parts of the body where the circulation of blood is good, such as the muscles, glands, and brain, saturate more rapidly than the ligaments, bones, and white matter of the spinal cord. The fat depots with their high affinity for nitrogen and very scant vascular supply will not be fully saturated for a long time. We must remember also that the rate of saturation for any given tissue is not uniform but is relatively rapid in the first few minutes after compression when the difference between blood and tissue is great and then slows up in a logarithmic curve as the pressure difference decreases. Conversely, when the pressure is reduced the rate of desaturation is also irregular and those parts of the body which acquire their nitrogen slowly give it up reluctantly. It seems probable that the fat acts as a reservoir during decompression and that the nitrogen tardily removed from it in solution may be liberated in the form of bubbles in parts of the body where they can do great damage.

The mathematics of the rates of saturation and desaturation are discussed by Haldane in the famous Admiralty Report of 1907 (6). Leonard Hill (3) has given a critical review of the matter in his book. The equation takes into account the volume of blood in the body, the time required for this blood to make one complete circulation, and the relative amount of fat in the body. There is a great deal of uncertainty in regard to all of these factors, and it is doubtful if we shall ever be able to approximate a measurement of the blood flow in certain parts of the body such as spinal cord, the bone marrow, and fat deposits, the very places that hold the keys to the puzzle. Therefore it does not seem worth while to reproduce the calculation here, and the reader who is particularly interested is referred to the works of Haldane (6, 7) and Hill (3). It is well known that there are great differences in the responses of different individuals and this has made all calculations difficult. Haldane has pointed out, however, that we do know from practical experience that saturation is not complete until a man has been exposed to a given pressure for about three hours. We also know that divers or caisson workers who have been exposed to pressures of $2\frac{1}{4}$ atmospheres, absolute, never get any symptoms due to the formation of bubbles even if the pressure is suddenly reduced to normal (1 atmosphere). The blood and tissues can hold twice as much nitrogen as we would expect from the saturation point. This is probably due in part to the colloidal

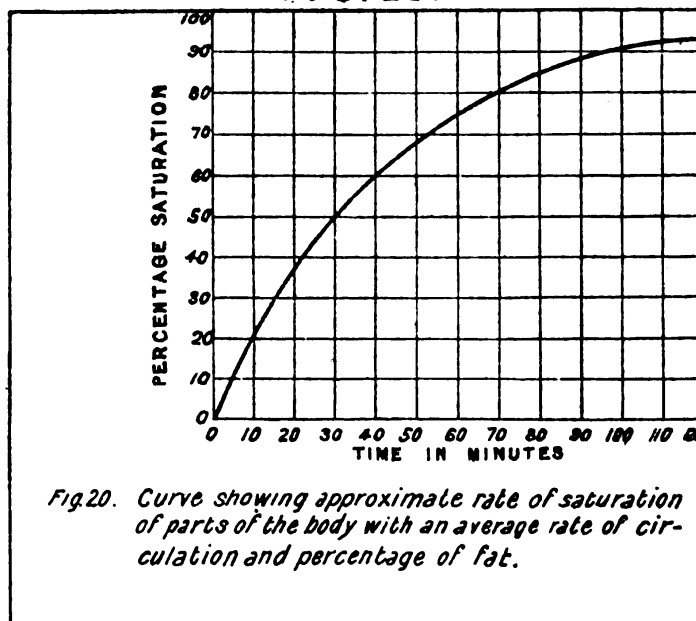
nature of the blood. Even water that has been exposed to a high pressure will hold much more than the calculated amount for saturation if it is not shaken when the pressure is removed. Hill and Twort have shown this in experiments and they refer to the fact that supersaturated solutions will not froth unless "points" are given for the bubbles to form on. Small bubbles, once formed, may act as "points" for larger bubbles. If small bubbles are formed in the tissues they may disappear on recompression, but large bubbles, especially if they block up the blood vessels in places where the circulation is slow, may take a long time to disappear, and this is probably one reason why it is necessary to keep patients a long time in the recompression chamber when treating caisson sickness.

Haldane reasoned that if men could be brought up from 40 feet of water and the pressure halved suddenly without any symptoms, it ought to be possible to halve the pressure suddenly if the man were at any depth. The volume change of a gas is the same when the pressure is dropped from 10 atmospheres to 5 atmospheres as when it is dropped from 2 atmospheres to 1 atmosphere. In this particular calculation it is the volume that counts, but we must not forget that 1 cubic centimeter of nitrogen at 10 atmospheres pressure contains five times as much gas by weight and five times as many molecules as does 1 cubic centimeter of nitrogen at 2 atmospheres pressure. Haldane's main contention was substantiated by some animal experiments of Boycott and Damant. If they did not diminish the absolute pressure more than to one-third, the animals were able to tolerate sudden drops of 60 pounds, whereas, if they diminished the absolute pressure to one-fourth, serious symptoms were caused by a drop of only 45 pounds. As a result of these theoretical calculations, animal experiments, and a large number of test dives under service conditions, Haldane and the Admiralty committee worked out the famous tables (6, 7) which have been adopted by almost all divers. It is not necessary to print them here, as they will be found in all diving manuals and service regulations, but we may take one specific example to show the application of the method.

If a diver is to work 35 to 60 minutes at a depth of 108 to 120 feet, he should get down to this depth as quickly as his ears will permit. When he has finished his period of stay at the bottom, he ascends the shot rope rapidly until he is stopped by signal at a depth of 40 feet. It has taken him about 2 minutes to come up this distance, and he remains at the 40-foot level for 5 minutes, next he ascends to the 30-foot level and waits there 10 minutes, then he spends 15 minutes at the 20-foot level, and finally 25 minutes at the 10-foot level. The whole process of decompression has required 57 minutes. The total required period is only one-quarter of an hour if the man stays less

than 15 minutes at the same depth. If he stays at the bottom 1 to 2 hours the decompression time is 97 minutes. A man who spends over 1 hour at a depth of 200 feet makes first a stop of 15 minutes at 80 feet and subsequent stops of increasing duration at each 10-foot mark, requiring a total of about 4 hours for decompression. This table is very convenient, and it has worked well in practice. Haldane (7) in his book on respiration, published in 1927, says that during the 12 years that the tables have been in use in the British Navy compressed-air illness has practically disappeared, except that when they tried to cut down the last wearisome stages of decompression the divers began to suffer from "bends." He therefore recommends that the times be not reduced.

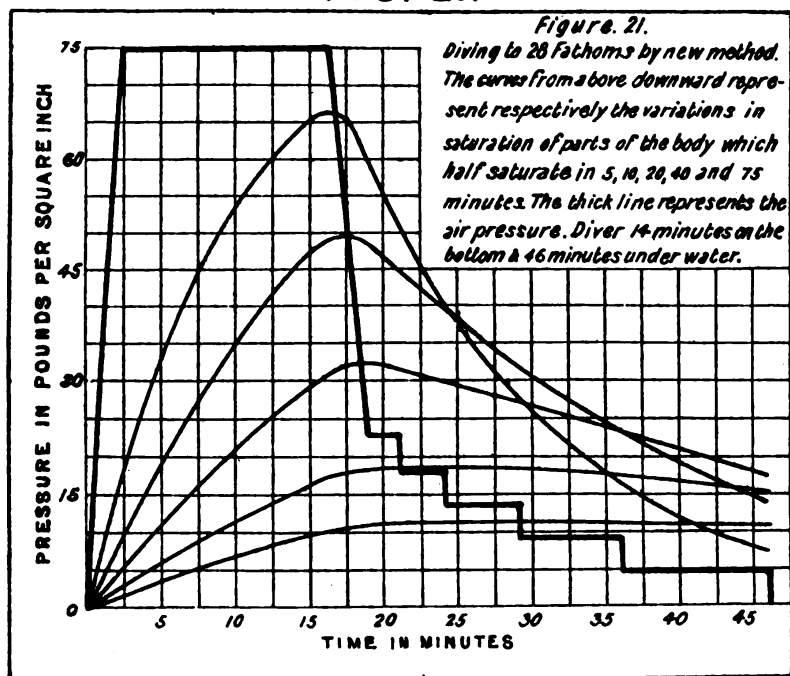
FIG. 20.



The new method of stage decompression is best illustrated by figures taken from the Admiralty Report (6). Figure 20 of this report shows schematically the rate of saturation of the average parts of the body. Figure 21 shows what happens when a diver descends to a pressure of 75 pounds and remains there 14 minutes and then comes up according to the stage method. The curved lines represent the degree of saturation of various parts of the body. Some parts with good circulation are almost completely saturated in the 14 minutes but they start to desaturate rapidly as soon as the diver comes up to the first stage of 23 pounds gauge pressure. The lower curved lines represent the parts which saturate (and desaturate) slowly. According to the diagram all the parts have

reached a saturation level below the danger point of 19 pounds (gauge) before the diver comes to the surface. In Figure 22 the old method of diving is shown. The diver descends slowly to the depth of 28 fathoms (75 pounds gauge pressure), and during this 35 minutes of descent the parts of the body which saturate rapidly become almost completely saturated. During the subsequent uniform decompression they desaturate slowly. The lower curves on this figure represent the "slow parts" which become more and more saturated up to the last few minutes of the decompression period. According to the diagram most of the parts of the body are saturated between 19 and 35 pounds gauge pressure when the man emerges

FIG. 21.

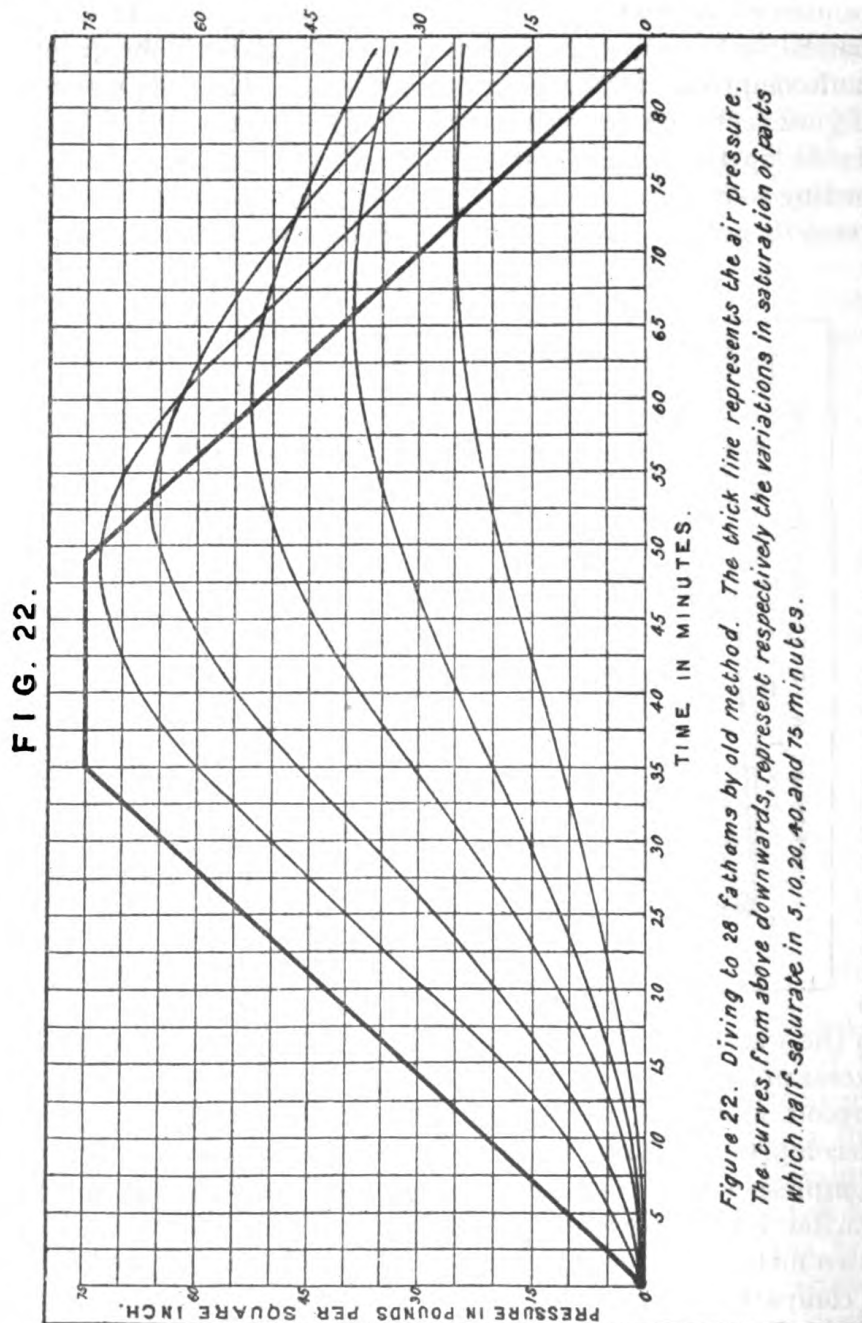


from the water and this is beyond the safe limit of $1\frac{1}{4}$ atmospheres of excess pressure.

Boycott and Damant compared the stage and uniform methods of decompression with goats and found that after short periods of compression the stage method gave distinctly better results but that after longer periods at high pressure the differences between the two methods were much less marked. Greenwood and Leonard Hill compared the methods on pigs, animals that contain about as much total fat as men. They were not able to find in their figures any proof of the superiority of the stage method. Some comparative studies by Bornstein (quoted by Hill) at the Elbe Tunnel

Works, Hamburg, showed a slight advantage in favor of the stage method. We may quote Hill (3) as follows:

The conclusion to be drawn, then, from experiments on animals is that there is evidence in favor of stage decompression after short exposures, but



no decisive evidence of its superiority after long exposures. The theory is a very captivating one, but experiment has not brought that conclusive support which was to be expected, and there is no evidence to substantiate the statement * * * (Haldane and Boycott): "Uniform decompression, to be safe,

has to be so prodigiously slow that it is altogether an irrational proceeding." Paul Bert had said very much the same thing in 1878.

It would seem that the chief advantage of Haldane's method lay in securing the shortest possible time of exposure to the greatest pressure. The quicker the diver can get down to the bottom the better, and experienced divers suffer no inconvenience from their ears. They learn to keep the Eustachian tubes fully open either by pressing the nose against the helmet and blowing into the naso-pharynx or by yawning or by some other trick which gives the same result. Of course during a rapid descent the air supply must be rapidly increased, but this is not difficult with the modern method of using compressed air instead of pumps. Some of the British divers were able without any difficulty to get down to 210 feet in two minutes. Stillson (5) in his report of 1915 says that the record at that time was held by Chief Gunner's Mate S. J. Drellishak, United States Navy, who subjected himself to 90 pounds excess pressure (201 feet) in 40 seconds. The quick descent saves time and so does the first rapid ascent to half pressure after finishing the work on the bottom. It is quite possible that improvements may be developed in regard to the later stages. Every minute that can be saved with safety means a great deal to the diver swinging on a rope or ladder in water, sometimes very cold water, after a period of hard work under dangerous conditions.

There are many difficulties connected with experimental work on animals under pressure. Small animals can not be compared very well with man because on account of their small bulk and relatively high metabolism per unit of weight the circulation is much more active. Therefore they saturate and desaturate more rapidly than man. In the same way young men with their higher metabolism saturate faster than old men, thin men much faster than fat men. They also desaturate much faster. The man who works hard while at the bottom increases his respiration and circulation three to four fold over the resting values and therefore saturates more rapidly than the man who stays quiet. Conversely the man who exercises during the period of decompression will increase his circulation beneficially and wash more nitrogen out of the blood and tissues. There is every reason to believe that decompression can be hastened by giving the diver oxygen to breathe during the last stage under water or just after emerging. The higher the percentage of oxygen in the alveolar air the lower will be the percentage of nitrogen and the greater the difference in pressure between the nitrogen in the alveoli and the nitrogen in the blood. Oxygen can not be administered at high pressures on account of the danger of poisoning.

The recent introduction of helium into deep diving may perhaps in time revolutionize our methods. In 1926, Sayers and Yant (8) wrote a report on this subject saying that Dr. J. H. Hildebrand had called their attention to the fact that helium has a lower coefficient of solubility than nitrogen and that it might possibly be of use in caisson illness. The coefficient of solubility of nitrogen at 30° C. is 0.0134, of helium 0.0081. Sayers and Yant consider that the greater diffusivity of helium would be an additional advantage, and in their experimental work on guinea pigs under high pressures of helium with oxygen they found no bubbles of gas in the fat and thought that this indicated that helium was less soluble than nitrogen in fats. They showed that helium was physiologically inert, causing no symptoms in guinea pigs and rats kept for long periods under high pressures of helium containing a low but adequate percentage of oxygen. Sayers and Yant suggest the advantage of using helium throughout the diving period or during its latter part. It might be used as a wash gas during decompression or as a treatment for the bends, the benefits being due to the removal of the partial pressure of nitrogen in the alveolar air. This work of Sayers and Yant has been extended during the last two years by Chief Gunner Tibbals. There are indications that helium will be of great service in deep diving.

CAISSON SICKNESS

The reader will find a complete account of the various manifestations of caisson sickness in the works of Heller, Mager, and von Schrötter (4) and Leonard Hill (3). All of the manifestations can be traced back to the liberation of bubbles of nitrogen in the blood vessels or tissues of the body and the symptoms depend chiefly on the size and locations of the bubbles.

Heller, Mager, and von Schrötter, in a statistical study of the cases of illness arising in the men working in the caissons at Nussdorf, found that in 32 per cent of all cases myalgia was the chief symptom. Arthralgia was most prominent in 19 per cent. Ear trouble with pain and hemorrhage made up 21 per cent. This is not due to bubbles of nitrogen but merely to pressure differences on the two sides of the tympanum. On the other hand, Meniere's complex with vertigo, vomiting, and deafness, present in 4.4 per cent of the cases is due to bubbles in the central tracts of the cochlea, or vestibular nerve or in the internal labyrinth of the ear. The remainder of the cases in the Nussdorf series were due to lesions in other parts of the nervous system. Keays, who reported on the large number of men who worked in the East River Tunnels of New York, found that 89 per cent of the cases of illness showed pains in various parts of the body ("bends"), 2.16 per cent showed symptoms referable to the

central nervous system, 5.8 per cent vertigo, 1.6 per cent dyspnea and sense of constriction of the chest, and 0.46 per cent showed partial or complete unconsciousness. The fatal cases amounted to 0.5 per cent of the total who presented symptoms. Caisson workers are not exposed to very high pressures, and in modern engineering works are carefully supervised so as to prevent many severe cases. Divers go to much greater pressures, and on account of circumstances which can not always be controlled they may have to come to the surface before an adequate period of decompression. They frequently suffer from pricking sensations in the skin or deep pains caused by bubbles of gas in the periosteum or bones or tendons. These may appear shortly after coming to the surface but often they do not occur for several hours, since it may take a long time before the bubbles form.

After sudden decompressions from high pressures death may follow rapidly due to the liberation of gas in the blood vessels and chambers of the heart. Most of the serious cases are due to the formation of bubbles in the white matter of the spinal cord in the dorsal region. This part of the nervous system seems to be particularly susceptible, perhaps on account of a poor blood supply. If the bubbles are of considerable size they can cause great damage by pressure and by interference with the nutrition of the part. Paralysis follows as a result of destruction of nerve tracts. These paralyses are usually permanent, they affect chiefly the body and legs but may effect any part. Patients often succumb to bed sores.

The prophylaxis of caisson disease depends on proper decompression. The treatment is recompression. All cases showing more than minor pricklings or "bends" should be recompressed as rapidly as possible, the degree of pressure depending on the severity of the symptoms and the pressure under which the man had been working. Recompression causes an immediate shrinking of the bubbles and usually their complete reabsorption. After the recompression comes a gradual decompression, usually slower than called for by the Admiralty tables.

Almost all large engineering works that employ caissons have medical locks for treatment and all ships conducting diving operations have or should have them also. If for any reason a medical lock is not at hand the man can be recompressed by putting him back in the caisson or by sending him below water in his diving suit. This is very inconvenient and not nearly as safe as the medical lock where the patient can receive the attentions of the surgeon.

There is still a great deal of work to be done on the subject of deep diving. Experimenters have made large numbers of tests on animals and on men, but there has been no uniformity of method that makes it possible to compare results satisfactorily. One can not

help wishing that the work had been directed by some international committee which had specified that certain standard exposures should be made, say at 6 atmospheres for 10 and 30 minutes and at 4 atmospheres for similar periods. There is still a possibility that some industrious investigator can solve the question of the best rate of decompression by making graphic charts of the large number of dives that are reported in the literature. These charts could then be assembled according to the different pressures and times of exposure and that method of decompression selected which gave the best results with the quickest decompression. Another method of attack would be the newer methods of physical chemistry. We badly need more data on the solubility of nitrogen, oxygen, argon, and helium in water, fat, blood, and the white matter of the nervous system. Such solubility tests should be made at various standard pressures for standard lengths of time and then different methods of decompression should be tried to find the quickest one which avoids the danger of bubble formation.

In concentrating our attention on the physiological aspects of deep diving it has been necessary to pass quickly over the pathological and clinical features of caisson disease. We have made only too brief a reference to the interesting self-contained diving suit of Hill and Davis and have passed over entirely the abortive attempts to construct rigid suits. We have not had space to discuss the mechanical side of such an important question as the air supply, but we can not omit a reference to the contribution of Lieut. W. J. Murphy (C. C.), United States Navy, who has recently made it safe for divers to work at a depth of 100 feet with a water temperature of 32° F. Before he introduced a practical method of removing water vapor from the air supply, divers working in these temperatures were nearly suffocated by blockage of the air pipe near the helmet due to the formation of spicules of ice. This matter has been discussed by Lieut. Commander G. H. Mankin, (M. C.), United States Navy, in the *NAVAL MEDICAL BULLETIN* (9). It is with particular regret that we have omitted the hundreds of fascinating stories of adventure that are to be found in the annals of deep diving.

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AMOEBIASES IN HAITI

By L. H. WILLIAMS, Lieutenant Commander, Medical Corps, United States Navy;
O. WILDMAN, Lieutenant Commander, Medical Corps, United States Navy; and LEE F.
CURTIS, Chief Pharmacist's Mate, United States Navy

Recent articles in the Journal of the American Medical Association by Craig (1) and Cort (2), and by Stuart (3) in the NAVAL MEDICAL BULLETIN aroused our interest to the point of checking over our laboratory records at the Justinien Hospital, Cape Haitien, Haiti, and doing some further work in the study of amoebiasis as encountered here.

Amoebiasis is endemic and widespread in this part of Haiti. The native negro population are carriers and have little or no idea of sanitation. Children become infected with the disease even before being weaned from the breast. The result is that the majority of the natives become carriers at some time in their lives. Acute exacerbations occur in individuals from time to time when their resistance to the parasite is broken down from various causes such as syphilis, malaria, and other intestinal parasitic infections. Operation and hospitalization will frequently bring on an attack of acute amoebic dysentery in an individual harboring cysts of *endamoeba histolytica*. Vegetative forms develop rapidly under these conditions, and an attack of typical amoebic dysentery supervenes to complicate convalescence.

The records of the laboratory over a 2-year period, since it has been in competent hands, showed a 16.26 percentage of *endamoeba histolytica* infection in hospitalized patients.

These examinations were made routinely on patients admitted to the hospital, both of specimens without the use of Lugol's solution and of specimens with Lugol's solution applied. On one end of the slide the specimen was unstained and vegetative forms were searched for here; on the other end the specimen had been stained with Lugol's solution and the cysts searched for there. Two thousand one hundred

and sixty-seven patients were examined in this manner with the finding of 5.81 per cent for vegetative forms and a percentage of 10.45 for cysts. Along with both vegetative forms and cysts, numerous other intestinal parasites were encountered: *Endamoeba coli*, *Endolimax mana*, *Giardia lamblia*, *Chilomastix mesnili*, *Iodamoeba bütschlii* and *Balantidium coli*.

The method of Craig impressed us as being such an advance over the simple Lugol's solution staining of liquefied faeces spread on a slide that we determined to give it a thorough trial in spite of the apparent time-consuming procedures necessary in the method. The result more than justified the extra labor involved.

The first day the method was tried 42 stools of hospitalized patients were examined. *Endamoeba histolytica* were found in 18 of these stools, a percentage of 42.8; *Endamoeba coli* in 15, a percentage of 35.7; *Endolimax mana* in 2, or 4.76 per cent; *Giardia lamblia* in 9, or 21.42 per cent. Thirteen stools were negative on this examination for cysts, a percentage of 30.

The percentage of 10.45 for *Endamoeba histolytica* cysts reported from our laboratory over a 2-year period compared with the percentage of 42.8 when the Craig method of sedimentation was used in the same laboratory, amply bears out the statements made by him as to the value of the method over former procedures. Its use will enable one to demonstrate the *histolytica* cysts in individuals in whom their presence is not suspected and who have no symptoms of amoebiasis. These individuals, however, are carriers and a potential menace to those about them.

A survey of 79 children in a rural school near Cape Haitien showed 34 per cent infection with *Endamoeba histolytica*. An examination of the stools of 60 apparently healthy native hospital employees showed 46 per cent of them to be carriers of *Endamoeba histolytica* cysts. These examinations were made prior to our knowledge of the Craig sedimentation and double-strength Lugol's solution method. With this method the percentage would undoubtedly have been considerably higher.

In an effort to discover the effect of preventive measures against infection with *Endamoeba histolytica*, the stools of 50 members of the United States Marine Corps stationed at the Marine Corps Barracks in Cape Haitien, were examined by means of the Craig method. Fifty gendarmes of the native constabulary force stationed at the gendarmerie barracks in Cape Haitien, were similarly examined.

The marines were all men who had been stationed in Haiti over a year. They had messed at the barracks, where the food was handled only by cooks of the corps and galley and mess hall screened against flies. The examination disclosed a percentage of 5.1 for

Endamoeba histolytica, 5.1 for *Endamoeba coli*, and 10.2 for *Giardia lamblia*. None of these men gave a history of an acute abdominal upset.

The gendarmes presented a very different picture. *Endamoeba histolytica* were found in 44.2 per cent of these men, *Endamoeba coli* in 51.9, *Endolimax nana* in 13.46, *Iodamoeba bütschlii* in 5.76, *Chilomastix mesnili* in 1.9, and *Giardia lamblia* in 25 per cent.

Ascaris lumbricoides ova were noted during the study of these stools in only 5.1 per cent of the marines and in exactly 50 per cent of the gendarmes. Hookworm ova were found in 17.3 per cent of the gendarmes and not observed in the marines.

With such a high incidence of infection among the native population one would expect to find much acute amœbic dysentery and the occasional occurrence of liver abscess among the natives and those whites long sojourning in the land. The vegetative form of *histolytica* was determined upon as the parasite causing the symptoms in 5.81 per cent of dysentery in hospitalized patients. The criteria for this determination were amœba showing ingested red blood cells and active pseudopodia with distinct ectoplasm.

During the search for *Endamoeba histolytica* it was constantly borne in mind that confusion may easily arise in the differentiation of *Endamoeba histolytica*, *Endolimax nana*, and *Endamoeba coli*. In spite of a 5.81 per cent of acute amœbic dysentery among the hospitalized native inhabitants, amœbic abscess of the liver is strikingly rare. We have encountered only one case which we felt was definitely amœbic abscess. This was cured by medical treatment.

The reason is probably due to the fact that the climate of northern Haiti is tempered by the trade winds the greater part of the year. Only in the spring and fall is it uncomfortably warm. At that time the trades do not blow across this part of the island with their customary gusto. It is during these months of comparative discomfort that fermentation processes in the intestines are most frequent with resulting diarrhea and gastric upsets. We have found acute amœbiases more prevalent during the spring and fall. Then patients are frequently seen with the history of constipation alternating with diarrhea, pain in abdomen, considerable gas formation, and sensation of distress in caecum, transverse colon, and sigmoid. Some have a severe diarrhea with marked loss of weight and strength.

Our experience in demonstrating the vegetative form of *Endamoeba histolytica* in some 120 persons, many of whom had only a mild diarrhea, has made us suspect its presence in all persons presenting themselves at the Justinien Hospital with symptoms of abdominal distress, however vague and fleeting these may be.

Intensive search, even before we adopted the Craig method, was successful often in turning this suspicion into a diagnosis with a happy result after treatment. Several of these acute diarrheas were diagnosed in operative cases who had been proven chronic cyst carriers at routine admission examination. The debilitation subsequent to operation was apparently enough to enable the vegetative forms to develop.

Caucasians residing in Haiti are apt to become infected with *Endamoeba histolytica* cysts and subsequently develop acute amœbic dysentery unless they strictly observe the avoidance of uncooked vegetables and fruit as well as unboiled drinking water. It is well also that they have their native servants examined at intervals to rule them out as carriers, and to protect their kitchens from flies so far as possible.

An interesting finding in the stools of many persons, especially whites new to the country, is the presence of *Giardia lamblia* cysts. These small cysts can generally be demonstrated in the stools of patients complaining of pain in upper right quadrant. As the duodenum is recognized as the site of election of *Giardia lamblia* they may have been the cause of the upper right quadrant pain. The majority of these individuals, however, are later proved to be carriers of *Endamoeba histolytica* cysts and some develop acute amœbic dysentery.

As a result of this observation over a period of some two years we have come to believe that the presence of *Giardia lamblia* cysts in the stools should be recognized as bearing the same relationship to amœbiases, at least in Haiti, as the presence of *B. coli* contamination in drinking water bears to *B. typhosus* contamination. Their presence certainly indicates that the person harboring *Giardia lamblia* cysts has ingested food contaminated with feces, in all probability human feces. With a population of approximately 200 to the square mile hourly contaminating soil and stream, it is difficult to escape the conclusion that the contaminating material is human feces, of which approximately 40 per cent in the rural sections contains *Endamoeba histolytica* cysts.

For the first six months of the period 1927-28 covered by this paper, only emetine hydrochloride was used in the treatment of amœbiasis, acute and chronic. The results were not entirely gratifying to either patient or doctor. Considerable time elapsed after beginning treatment before the pain and frequency of stools abated; convalescence was prolonged; eradication of cysts was difficult and frequently impossible to effect. Some 18 months ago Yatren was placed on the supply table of the Service d'Hygiene. It was administered both by mouth and by rectum in the form of enemata. It

proved to be much more efficacious in relieving pain and eradication of vegetative forms and cysts. But it caused such a severe diarrhea in many cases that its use had to be suspended and emetine substituted.

A preparation, p-oxy-m-acetylaminophenylarsinic acid, known under the trade name of "Paroxyl," was next made available for use in the hospital here. It proved to be of such great value that we were delighted with it and intended to use it exclusively. Its high cost, however, prohibits this general use. Given in conjunction with bismuth subnitrate, Paroxyl may be depended upon to relieve the pain and diarrhea of acute amœbic dysentery in less than a week in the average case. The dosage of Paroxyl is a 4-grain tablet to be taken three or four times daily. The bismuth dose is a teaspoonful in water four times daily. Diet need not be liquid but is best taken in less quantity. Paroxyl should be taken under the care of a physician, as there is some danger of arsenical poisoning in susceptible individuals. We had one such case of fairly severe arsenical poisoning, in a mulatto woman, who was undergoing treatment for amœbiasis. Intravenous sodium thiosulphate was quickly effective.

We have had uniformly successful results with giving Paroxyl for a week along with bismuth subnitrate, withholding Paroxyl for a week, and then resumption for a similar period until there is a clinical and laboratory cure. The bismuth is continued throughout the full course of treatment. Rest in bed is not essential, though advantageous in the acute stage. Frequent stool examinations are made during the course of treatment. The patient is not considered cured until all symptoms have disappeared and three stools have proved negative.

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DISQUALIFYING EYE-MUSCLE IMBALANCES IN AVIATORS

By A. W. Loy, Lieutenant (junior grade), Medical Corps, United States Navy

It is the purpose of this paper to present a diagrammatic representation of the disqualifying eye-muscle imbalances, which appear in the examination of applicants for aviation duty. It is desirable,

if possible, to elucidate the reasons for disqualification in certain conditions, and this is accomplished better, for some of us, by diagram than by the printed page.

Often these examinations are given without full appreciation of the significance of the conditions found by the examiner. It is, relatively, a simple matter to detect eye-muscle imbalance, to measure that imbalance by prescribed procedure, and to point out disqualifying conditions; but it is more difficult to understand the cause for disqualification, other than by reference to requirements by regulations. A thorough understanding of the principles involved facilitates the procedure and makes the examination more valuable. It is recognized that the normally functioning eye is the greatest asset to the aviator. Visual acuity and normal muscle balance are imperative. Usually visual acuity is normal because of the requirements for entry into the service, but the testing and interpreting of the muscle balance becomes the chief responsibility of the flight surgeon in the eye examination.

The accompanying chart presents conditions as applied to the left eye, as the nonsighting eye. In case of the right eye as the nonsighting eye, the chart would be reversed.

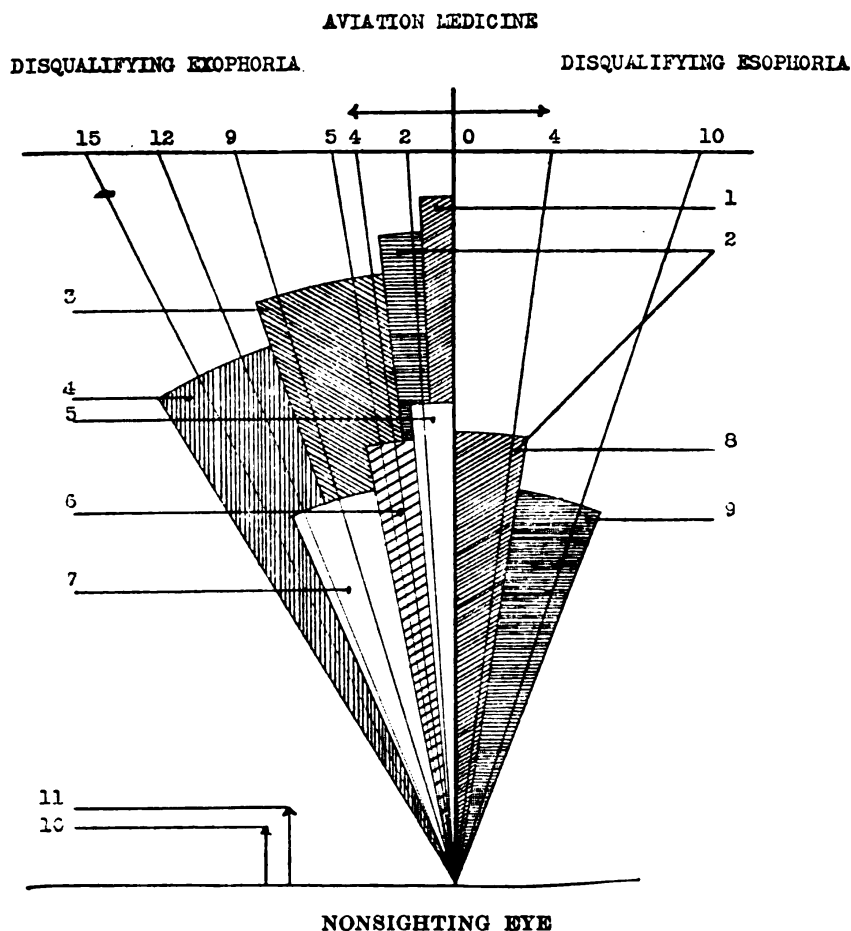
It is noted that the chart presents conditions of horizontal imbalance which are represented either as disqualifying esophorias or as disqualifying exophorias.

No. (1) is disqualifying because of displacement of muscle balance from the normal of prism divergence of 4 D toward the esophorias. In this case, it is expected that there will be a disqualifying esophoria. It is well to note that a diplopia on the tangent curtain, in this case, would be of the homonymous type.

No. (2) is a disqualifying esophoria. The prism divergence less than 4 D but greater than 2 D is not disqualifying, although it shows divergent weakness; but when associated with convergence strength as shown by esophoria greater than 4 D it becomes a disqualifying condition. Diplopia on the tangent curtain would be of homonymous type.

No. (3) shows divergent strength (normal 4 D) but is not disqualifying unless associated with convergent weakness as shown by an angle of convergence near 40. Diplopia on the tangent curtain would be of the crossed type.

No. (4) shows a decided displacement of power toward exophoria, by the prism divergence greater than 15 D. We would expect to find a disqualifying exophoria also, and an angle of convergence below 40. Diplopia on the tangent curtain would be of the crossed type.



1. Prism divergence less than 2 D.
2. Prism divergence less than 4 D, associated with esophoria greater than 4 D.
3. Prism divergence greater than 9 D, associated with angle of convergence near 40.
4. Prism divergence greater than 15 D.
5. Exophoria greater than 2 D at 6 meters, associated with (1) angle of convergence near 40, or (2) diplopia in the lateral positions on the tangent curtain.
6. Exophoria greater than 5 D at 6 meters.
7. Exophoria greater than 12 D at 33 centimeters.
8. Esophoria greater than 4 D at 6 meters associated with (1) diplopia in the lateral positions on the tangent curtain, or (2) accommodation 2 D below or above that given for normal for age in Duane chart, or (3) hyperopia near the disqualifying limit, or (4) prism divergence less than 4 D.
9. Esophoria greater than 10 D at 6 meters.
10. Hyperphoria greater than 0.75 D is disqualifying for applicants.
11. Hyperphoria of 1 D is allowed for qualified aviators.

NOTE.—Normal exophoria at 33 centimeters is 4 D; normal exophoria at 6 meters is 0; normal esophoria at 6 meters is 0, but unassociated with other condition, is not disqualifying below 10 D.

No. (5) with an exophoria greater than 2 D shows a displacement of power toward the exophorias; but it is not disqualifying, unless associated with convergent weakness as shown by an angle of convergence near 40, or with crossed diplopia in the lateral positions on the tangent curtain.

No. (6) shows a decided displacement of power toward the exophorias. Diplopia on the tangent curtain would be of the crossed type.

No. (7) shows the same condition as No. (6). Diplopia on the tangent curtain would be of the crossed type.

In No. (8) there is convergent strength, which is not significant unless associated with divergent weakness, as shown by prism divergence less than 4 D or by homonymous diplopia on the tangent curtain, or by hyperopia near the disqualifying limit, or by changes in accommodation associated with hyperopia. The convergence may be secondary; and it may have developed simultaneously with increased accommodation, which has developed because of the hyperopic condition. A diplopia would be of the homonymous type.

The esophoria may be due to weakness of the divergent group of muscles, which is made up of the lateral rectus, the inferior, and the superior obliques. A weakness of the left superior oblique or of the right inferior oblique will cause a left hyperphoria; and a weakness of the right superior oblique or of the left inferior oblique will cause a right hyperphoria. Such hyperphorias may be associated with divergent weakness. Diplopia on the tangent curtain would be of the homonymous type and the false images would be slanting in the lateral positions because of the cyclophoria.

Hyperphoria may be due to overaction of the superior or inferior recti muscles, which results from over adduction, associated with effort of accommodation in hyperopia.

In No. (9) there is a displacement toward esophoria. In high degrees of esophoria there may be good distant vision, because there is usually associated a high degree of hyperopia. It may be noted, however, that there is no binocular fixation, which is so essential for judging the distance of objects in relation to the subject and in relation to each other. There may even be reduced vision in the nonfixing eye or there may be homonymous diplopia. Such changes are due, first, to hyperopia; secondly, to increased effort of accommodation associated with convergence for near vision. This may lead to esotropia and even to hyperphoria and hypertropia.

By association of the prism divergences, the esophorias and the exophorias by a diagram such as this, the relationship of the disqualifying conditions become apparent.

THORACIC EMPYEMA¹

By L. E. McDONALD, Lieutenant (junior grade), Medical Corps, United States Navy

Empyema of the thorax means pus in the pleural cavity. It is the reaction of the pleura to infection.

The treatment of empyema has undergone much of the same transition as did the question of appendicitis a few years ago. Now certain clearly established principles seem to warrant some degree of standardization of treatment. The purpose of the present article is to dwell chiefly upon some of these principles rather than upon detail. The essential points of these principles of treatment are as follows:

- (1) Careful avoidance of pneumothorax in the early acute stage.
- (2) Prevention of chronic empyema by rapid sterilization and obliteration of the infected cavity.
- (3) Careful attention to the nutrition of the patient.

The rationale of application of these principles is based largely upon the pathology present, therefore an accurate knowledge of the common pathological findings is important. The statement that the type of organism is unimportant from the standpoint of treatment is not correct. There is a very great difference between the pathology and clinical course of a streptococcic empyema and a pneumococcic empyema. The essential types which McCallum (1) describes from the standpoint of treatment are: (1) Those with extensive involvement, with massive exudate; (2) those with dyspnea; and (3) the type having a tendency to rapid organization of the pleural exudate as in the streptococcic cases, against the relatively less disturbance of air intake and a much less rapid organization of exudate which occurs in pneumococci cases.

The first important point to be discussed is the avoidance of pneumothorax in the acute stage. By pneumothorax is meant a condition in which there is a free entrance and exit of air into the pleural cavity. Under normal conditions the act of respiration depends chiefly upon an alternate expansion and contraction of the chest. The enlargement of the thorax during inspiration necessitates the inrush of air down the trachea into the lungs to equalize pressure within and without the lungs. It follows, therefore, that the pressure within the pleural cavities is less than atmospheric pressure and is commonly called negative pressure. This pressure is at its lowest value at the end of inspiration. Various determinations have been made of the intrapleural negative pressure and there is a variation in findings. However, Donders (2) gives the correct figure as -7 at the end of expiration, and -9 at end of inspiration. It is readily

¹ Read before the staff of the U. S. Naval Hospital, Mare Island, Calif., Aug. 31, 1928.

seen, therefore, that respiration can not go on unless at some time during the act of inspiration the intrapleural pressure becomes less than that of atmospheric pressure. The patient's ability to stand an open pneumothorax depends much upon the relative size of the opening into the pleural cavity. The amount of air passing down the trachea into the lungs will depend upon the pressure within the pleural cavity. With almost an entirely positive pressure little air can go in by way of the trachea. In this condition there is an attempt to compensate by making a greater effort to get air into the lungs. As a rule there is a change in amplitude of the respiratory movement rather than an increase in rate. The ability of the individual, therefore, to withstand an open pneumothorax is dependent upon his ability to compensate by increasing his respiratory effort. It has long been the belief that a person could not withstand a bilateral pneumothorax. This has been proven erroneous by Graham (3). A very large opening may be made in the chest wall with relatively little embarrassment to respiration provided the patient's vital capacity is normal. By vital capacity is meant: Tidal air about 500 cubic centimeters, complementary air 1,500 cubic centimeters, and supplemental air 1,500 cubic centimeters; total about 2,500 to 3,000 cubic centimeters. This may be accurately determined by a single spirometer and the results of an open pneumothorax be calculated.

Given then a patient in the acute stage of empyema when there is a very low vital capacity, in which there is massive exudate, in which the immobilization and fixation of mediastinum has not been accomplished, and with the clinical symptoms of an acute empyema, one realizes the importance of not adding a greater load and making respiration more difficult by having an open pneumothorax. Any condition which reduces the vital capacity or increases the demand for oxygen will of necessity diminish the size of opening compatible with life. Old inflammation of the mediastinum with extensive induration will of itself result in a more rigid partition between the two pleural cavities and the effect of an open pneumothorax will be felt less. These factors tend to make a deferred operation in an acute empyema more desirable than ever, especially if an open pneumothorax is done.

There are other effects of an open pneumothorax besides those upon respiration. Sauerbruch (4) has summarized them as heat loss, danger of infection, and disturbances of circulation. Important observations on heat loss have been made. Sauerbruch has shown that heat loss in an open pneumothorax is greater than in an extensive laparotomy with eventration of the intestines for the same length of time. The effect of secondary infection is known to every-

one who has had any experience with empyema or sucking wounds of the chest.

Sauerbruch has noted marked disturbance in the general circulation following an open pneumothorax. He states that in pneumothorax the aspiration of the heart fails and a stasis results in the venous system. Measurements of venous pressure show an increase in pressure—but as a rule there is no change in arterial pressure.

It would thus seem apparent that an operation for empyema which carries with it the dangers of an open pneumothorax, if performed too early in the course of disease, is accompanied by such very grave risks that the danger of harm from the operation outweighs the advantage which it may have. If, however, the acute stage has passed and frank pus is present, there is comparatively little danger to be feared from an open pneumothorax for the purpose of securing free drainage for the following reasons:

(1) There is little danger of creating an open pneumothorax because in most cases there is apt to be a circumscribed walled-off abscess shut off by adhesions from any communication with the free pleural cavity.

(2) Even if a pneumothorax is created the patient is in better condition to withstand the effects of the operation.

(3) The patient is in better condition to withstand whatever shock accompanies pleural drainage.

(4) There is less risk of creating a septicemia from absorption of organisms from fresh operation wound.

The desirability of avoiding an open pneumothorax has led to invention of many devices, such as the Potain aspirator, which have as their object drainage without admission of air into the pleural cavity. In acute empyema an open pneumothorax may be avoided and yet drainage secured by a closed suction apparatus, or by repeated aspiration. Theoretically, the early establishment of continuous drainage with negative pressure would have the advantage of keeping the pleural cavity free from liquid exudate and organisms, and of aiding expansion of the lungs as well as avoiding an open pneumothorax with its dangers.

The second important principle in the treatment is the prevention of chronic empyema. The object of treatment then is to sterilize and obliterate the cavity. Unless these two objects are accomplished, healing does not take place. The best antiseptic solution known at the present time is Dakin's solution. It loses its effectiveness quickly when in contact with the albuminous contents of an exudate, so drainage of the old solution with frequent installations of a fresh preparation is very important. The reason for failure of these

cavities to be obliterated is due chiefly to an inability of the lung on the affected side to expand sufficiently to fill up its side of the thorax. This inability to expand is due chiefly to the following factors:

(1) Fibrosis of lung as a result of inflammation.

(2) The thick inelastic coat of exudate which envelops the lung prohibits expansion. It is desirable to remove this exudate early, because it is known that early organization occurs, especially in streptococcic cases, and the longer it remains the harder it is to obliterate the cavity. Dakin's solution, theoretically, is ideal because it sterilizes and at the same time has a solvent action on the exudate.

Obliteration of a cavity is accomplished by—

(a) Enabling the lung to expand to fill the cavity.

(b) Allowing the chest wall to collapse to meet the lung.

The first is the Fowler-Delorme type of procedure, operative decortication, which is attended with high mortality. Collapsing operations have many disadvantages. They are always very mutilating and they have a bad cosmetic effect. The effect of collapsing a chest wall is permanent. The vital capacity is markedly lowered and the patient's later activities are limited. This marked reduction of vital capacity in Schede's operation, which is essentially collapse of the chest wall, leaves the patient in such a condition that he has only a 50 per cent chance of recovery as compared with what he would have if the vital capacity were normal.

The closure of empyematous cavities after sterilization despite the presence of pneumothorax has been recommended by Stewart, Tuffier (5), Heuer, and others. Graham believes this is bad judgment. He would close the opening only after laboratory methods proved the cavity practically sterile and after expansion of the lung to fill the cavity was highly probable after closure.

The last important principle is careful attention to the nutrition of the patient. R. D. Bell (3) of the empyema commission has made some very important observations. He has shown that these patients have a negative nitrogen balance amounting to a deficit of as much as 20 grams a day. If a patient is losing in his excretions 20 grams of nitrogen per day more than he is taking into his body, it is not surprising that he loses weight rapidly. This adds an additional handicap to the efforts of combating a serious infection. If, however, he is given 3,300 to 3,500 calories his nitrogen balance will be positive, and he will gain in weight instead of losing. It is as important to see that these patients have a sufficient quantity of food as it is to attend to any other part of the treatment of empyema. Not only is it important to maintain nutrition, but there is a necessity of keeping up the water balance by liberal administration of fluids. Recently a new significance has been given this question. Bolcar (6),

Sansum, and Woodyatt have shown in various infectious diseases that the fever may be due to an insufficient amount of free water in the body; that is, water which is not bound by physical or chemical union to various substances in the body.

In conclusion, the three principal points in treatment may be summarized as follows:

- (1) Careful avoidance of open pneumothorax in the acute stage.
- (2) The prevention of chronic empyema by rapid sterilization and obliteration of the cavity.
- (3) Careful attention to nutrition of patient.

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ANTIDOTING SOME COMMON POISONS WITH CHEMICALS LISTED ON THE UNITED STATES NAVY MEDICAL SUPPLY TABLE

By W. ZUR-LINDEN, Chief Pharmacist, United States Navy

Toxicology in the naval service is as different from that of civil life as is military medicine from the practice of medicine in civil life; each has its peculiar problems. The fact that a naval organization must be mobile precludes having more than a limited amount of drugs and chemicals for the treatment of the sick and injured and for the preparation of antidotes in cases of poisoning. With this in view an effort has been made to find suitable combinations from "Supply Table" chemicals to antidote effectively some of the more frequent causes of accidental and suicidal poisoning.

The enthusiastic statements regarding the efficacy of sodium thio-sulphate as an antidote for various metallic poisons, especially arsenic, has brought out the fact that while this chemical succeeded with the organic compounds of arsenic it has proved quite useless in controlling the effects of the more toxic and inorganic arsenicals. In such compounds as salvarsan and neosalvarsan the arsenic is present in the latent dioxide form. Through the process of respiration this dioxide form is gradually oxidized into the active trioxide form, thereby

exerting active arsenical medication in the blood stream for several days. Were it not for the fact that this arsenic is in a latent form, there would be contained in a single dose of salvarsan enough arsenic to poison about 10 persons. The fact that the arsenic in these organic arsenicals is only gradually released makes it generally quite safe to use large doses of these drugs.

In spite of this, however, we find in certain persons to whom these organic arsenicals have been administered alarming evidences of arsenical poisoning. To quote H. B. Haag and W. R. Bond (*Journal of the American Medical Association*, Apr. 16, 1927, p. 1219), "Whatever may be the virtues of sodium thiosulphate in the treatment of the dermatitis produced by the organic arsenic preparations, there does not seem to be any doubt that it is valueless against the poisoning produced by the oral administration of solution of potassium arsenite (Fowler's solution)." And so we go back to the old reliable arsenic antidote of the pharmacopœia. In this instance the supply table fails to provide the chemicals for preparing the United States Pharmacopœia antidote. However, the following antidote can be prepared from supply table chemicals and is effective for at least 10 grains of arsenic trioxide. To eliminate weighing and accurate measuring, which cause a considerable loss of time, this antidote may be prepared by mixing a 1-ounce medicine-glass full of United States Pharmacopœia tincture of ferric chloride in a common drinking-glass with the same medicine glass full of sodium bicarbonate and then gradually adding enough warm water to fill the glass (about 8 fluid ounces). Stir well and give the entire amount as one dose. Follow by emetics and gastric lavage. In about 10 minutes administer another portion of the antidote, and again follow by emetics, etc.; then give demulcents and treat symptoms as they arise.

A true chemical antidote for a poison possesses definite advantages over gastric lavage, as lavage can only be practiced by someone specially trained and requires considerable time for its performance. In corrosive poisoning the statement is often made that emetics are contraindicated, as the poison will "burn" again on its way outward, and that the act of vomiting may cause rupturing of the already injured stomach. While this is true in some special cases, emesis is nevertheless still one of the best methods of removing poisons from the stomach and requires very little time.

The next antidote of importance that may be prepared from supply table chemicals is lime water. On page 20 of the new supply table is listed calcium oxide which, when dissolved in water as directed in the United States Pharmacopœia makes the well-known but often improperly prepared "lime water." In order to secure the full benefit of its chemical properties this preparation must be carefully

made and kept in completely filled and tightly stoppered bottles to prevent the absorption of carbon dioxide from the air, which will gradually convert the calcium hydroxide into the inert calcium carbonate (chalk).

As to antidotes against the familiar bichloride of mercury, until quite recently the various professors of pharmacology and toxicology taught the usefulness of egg albumin in the treatment of bichloride poisoning. Students were cautioned not to give too much egg white as an excess would redissolve the albuminate formed. Just what "too much" was, finally was determined to be not more than the white of one egg for each 4 grains of the poison ingested. If the suicidally inclined person knew not or would not tell how many grains of the poison he had taken, then giving the antidote consisted in making a good guess and trusting the rest to chance. The size of the egg, apparently, did not enter into the calculation and, as we well know, hens' eggs vary in size. As time went on, along came someone with a perfectly new theory that it was far better to give sodium thiosulphate as the antidote for bichloride of mercury poisoning. But in a series of experiments the writer found that it did not possess any value when used orally. In these experiments it was also demonstrated that egg white formed an antidote of limited value even when given under the most favorable conditions. Tinned evaporated milk was also used and found to have practically the same value as egg albumin. Of course it must be understood that a perfect antidote does not exist for any particular poison or class of poisons. It appears that by using slightly in excess of 1 pint of United States Pharmacopœia lime water a very reliable antidote for at least seven United States Pharmacopœia bichloride of mercury tablets is available. In view of the foregoing, it is recommended that gastric lavage with a pint of United States Pharmacopœia lime water be employed, and repeated if thought necessary. In the hands of the inexperienced, the patient should be made to drink the pint of lime water and then be given emetics (preferably one-twelfth grain of apomorphine hydrochloride). These steps may then be followed by a mixture of milk and egg albumin as demulcents and to render inert any traces of remaining poison.

The following is a report of chemical examination based on Reinsch's test in regard to various antidotes used in bichloride of mercury poisoning:

Fifty grains of bichloride of mercury treated with 550 cubic centimeters (slightly over 1 pint) of United States Pharmacopœia lime water gave practically a negative reaction.

Fifty grains of bichloride of mercury in solution with 50 grains of ammonium chloride when treated with a pint of United States Pharmacopœia lime water gave a slightly positive reaction.

Fifty grains of bichloride of mercury in solution treated with the whites of six hen eggs of average size produced a markedly positive test. Curdling was increased by adding a small amount of United States Pharmacopœia hydrochloric acid (to simulate gastric juice) but the reaction was still strongly positive.

Fifty grains of bichloride of mercury in solution when treated with 50 grains of sodium thiosulphate produced a positive reaction.

Fifty grains of bichloride of mercury in solution with 50 grains of ammonium chloride when treated with sodium thiosulphate produced a highly positive reaction.

As a result of these experiments it appears that lime water is the best antidote for bichloride of mercury; that egg albumin is of limited value; and that sodium thiosulphate is worthless, especially when ammonium chloride is present. The United States Pharmacopœia allows the use of ammonium chloride or sodium chloride in the manufacture of bichloride tablets, but the majority of the tablets which have come under the writer's observation have contained the chloride of ammonium. For this reason ammonium chloride was added to the bichloride of mercury solutions so that the poison would be more nearly in the state in which it is taken in the tablet form.

Oxalic acid is frequently used for cleaning "bright work," etc., and is sometimes mistaken for Epsom salt. This poison is best antidoted by giving lime water or chalk. Often in cases of this kind of poisoning persons are inclined to give the soluble carbonates on the theory that alkalies neutralize acids. In this case the soluble carbonates do neutralize the acid, but they also form soluble oxalates which are equally as poisonous as the original poison. The after treatment is identical with that for bichloride of mercury.

In poisoning by free iodine, most textbooks on toxicology recommend the use of cornstarch or other starch as an antidote. The starch forms with free iodine a blue compound called starch iodide. This compound is so feeble that substances which are acted upon by free iodine remove the iodine from iodide of starch, thus demonstrating that it is of very limited value in iodine poisoning. The toxicity of sodium thiosulphate is extremely low, which fact has been demonstrated by the impunity with which large doses may be given for cathartic effects. By intravenous injection into dogs, it has been found that amounts as large as 2.5 grams, or about 40 grains, may be given per kilogram of body weight with safety. When sodium thiosulphate reacts with free iodine there is formed at once sodium iodide and sodium tetrathionate, both of which are far less active than the original highly irritant free iodine. For use as an antidote, it is recommended that a heaping teaspoonful be dissolved in a glassful of warm water and the entire amount given

at once. This should be followed by emetics (apomorphine hydrochloride) and then by demulcents.

Within recent years a great number of new silver compounds have been made available to the medical profession. They have been devised to avoid the limited action of silver nitrate, as this drug has the property of coagulating proteids, causing much irritation, and, in addition, forms insoluble compounds in contact with chlorides. Obviously the silver proteins are not precipitated by ordinary reagents, such as chlorides, bromides, sulphides, and so forth, therefore sodium chloride, which is the best antidote for silver nitrate, is quite useless for antidoting the silver proteins listed on the United States Navy Medical Supply Table. While these compounds are comparatively nonirritating, they are, nevertheless, poisons when absorbed and are capable of producing all the other physiological effects of silver salts. When solutions of these proteins are treated with small amounts of tannic acid an immediate precipitate which is practically inert forms, therefore it is recommended that they be antidoted by using a level teaspoonful of United States Pharmacopœia powdered tannic acid dissolved in a glassful of warm water. Follow by emetics or gastric lavage to prevent absorption.

Death due to cresol and phenol poisoning is usually the result of shock or from cardiac and respiratory failure due to the depressant action of these chemicals, the latter being much more rapid in its action than the former. Phenol and cresol are so closely related in composition and physiological action that they may be considered together in toxicology. Cresol chemically is methyl phenol and its physiological action is identical in all respects to phenol except that the symptoms of depression and collapse are much delayed; several hours, in fact. Experiments demonstrate that some samples of cresol are more toxic than others. The United States Pharmacopœia defines cresol as a mixture of three isomeric cresols, termed ortha, meta, and paracresol, but does not specify the amounts of these present, which accounts for the differences in toxicity.

Numerous substances have been recommended and used to antidote these poisons, but the majority are without value. Years ago it was taught that alcohol was the sovereign antidote; then came the soluble sulphates, which dominated the field for a number of years; but, to-day we find them in the scrap-heap of phenol antidotes. Alcohol, phenol, and cresol are hydroxides and it is obvious that they will not ordinarily react with one another. In addition to this, alcohol is an excellent solvent for these chemicals and for this reason it is very useful externally to dilute and remove these substances from the skin but, internally, alcohol facilitates absorption. While men-

tioning absorption, it is well to state that oils, fats, and glycerine also aid absorption of phenol and cresol and their use is therefore contraindicated.

The writer demonstrated that the soluble sulphates are useless as antidotes in these poisons. Apparently, no reaction takes place between them and the soluble sulphates advocated as antidotes. An antidote prepared by mixing a half fluid ounce of United States Pharmacopœia tincture of ferric chloride and one-half fluid ounce of aromatic spirit of ammonia practically destroys the caustic action of phenol or cresol, but the antidote is still not perfect. However, it, along with a fresh solution of egg albumin, probably makes the best antidote for these two poisons. The next step is to remove the poison through the use of a stomach tube or emetics and then carefully to wash out the stomach with warm water containing sodium bicarbonate. This should be followed by demulcent drinks prepared with milk and egg albumin. The physiological symptoms are best treated by giving atropine sulphate to support the heart and respiration.

The frequency of wood alcohol poisoning since the advent of prohibition would lead one to believe that this subject should be thoroughly covered by toxicologists and pharmacologists. It is extremely disappointing when one attempts to determine from various textbooks the minimum lethal dose of methyl alcohol. Observations made from numerous reports of wood alcohol poisoning make it evident that as little as 20 cubic centimeters, or approximately five teaspoonfuls, will produce blindness and that amounts as small as 60 cubic centimeters frequently cause death. Recovery frequently follows when as much as one-half pint has been taken, but these victims generally suffer partial or complete blindness through optic nerve atrophy. What is the fate of this poison in the organism? The statement is frequently made in textbooks on materia medica and toxicology that its toxicity is due to the fact that wood alcohol is not oxidized in the system. Nothing could be further from the truth and the fact is that it is oxidized in the organism into formaldehyde and formic acid and is finally excreted as sodium formate. The presence of formaldehyde or formic acid in the organism following poisoning with wood alcohol is evidenced by the fact that the blood of such patients shows an increased reducing power. The blood of wood alcohol victims suggests renal failure, as there is a steady rise in uric acid, urea, and creatinin. Renal failure is demonstrated in post-mortem findings of parenchymatous nephritis.

The fact that formaldehyde and formic acid are finally converted into sodium formate in the organism suggests the use of some agent to accelerate this conversion. Theoretically, sodium bicarbonate

should bring about this change and will also probably cause the greater portion of the formate to be excreted in the form of a carbonate or bicarbonate. It is thought that the daily administration of 200 cubic centimeters of 4 per cent sodium bicarbonate intravenously supplemented by oral administration of 4 grams (about 60 grains) of the same substance three times a day until the urine becomes alkaline to litmus paper increases the chances for recovery.

The immediate first-aid treatment should consist in promptly giving emetics, followed by gastric lavage with warm water containing sodium bicarbonate. This should be followed by a liberal dose of magnesium sulphate to prevent absorption (exosmosis). In preparing sodium bicarbonate solutions for intravenous use it must be remembered that raising a solution of this chemical to 150° F. causes its decomposition into the normal carbonate, which is undesirable. To prepare this solution for intravenous use the writer first sterilized all utensils and the distilled water and then, with proper precautions, dissolved in this the required amount of sodium bicarbonate.

Formic acid in dogs produces symptoms identical with those of wood alcohol. The substance not only produces a dangerous state of acidosis, but acts as a direct poison. Large doses of sodium bicarbonate have markedly beneficial effects on experimentally poisoned dogs.

It is always the unexpected that happens. If we have prepared an elaborate defense against certain contingencies we generally find that it is necessary to deviate from the original plan to cope with the situation at hand. Toxicology is by no means a perfect science, hence it fails quite frequently because its students have not learned to alter their plans to suit the widely different emergencies which are so typical in accidental and suicidal poisonings. For this reason, the United States Naval Hospital, Norfolk, Va., maintains an emergency-treatment room in which there are available a number of trays supplied with special equipment for all varieties of emergencies. The medical officer and his assistants have on hand instruments, drugs, dressings, and many other things of equal importance, thus saving valuable time and avoiding the possibility of having to go to the various hospital departments in search of means to cope with the emergency.

In this emergency-treatment room there is also a "Poison" tray which contains a framed chart listing some of the more frequent poisons and their antidotes. This tray provides adequate materials for combating the following poisons:

Alkaloids, arsenic, acids, bichloride of mercury, cresol, carbolic acid (phenol), iodine, silver nitrate, silver proteins, and oxalic acid.

The contents of the tray include the following:

- 2 pints of lime water, United States Pharmacopœia.
- 1 tube of atropine sulphate hypodermic tablets.

- 1 tube of apomorphine hydrochloride hypodermic tablets.
- 1 bottle of sodium thiosulphate.
- 1 bottle of tannic acid (powdered).
- 1 pint of $\frac{1}{2}$ per cent potassium permanganate (phosphorus antidote).
- 1 pint of 10 per cent solution of sodium chloride.
- 1 pound of powdered sodium bicarbonate.
- 1 bottle of aromatic spirits of ammonia.
- 1 bottle of tincture of ferric chloride.
- 1 lavage tube.
- 1 hypodermic syringe with needles.
- 1 medicine glass.
- 1 8-ounce drinking glass.
- 1 tablespoon.

CLINICAL NOTES

PRESERVATION OF THE FACIAL NERVE IN THE EXCISION OF PAROTID TUMORS

REPORT OF TWO CASES

By C. M. SHAAR, Lieutenant, Medical Corps, United States Navy

The facial nerve is frequently severed in the excision of parotid tumors which results in paralysis and great disfigurement. The weeping eye that can not be closed, the dribbling mouth, the affected speech, the impaired mastication, and the blank stare to express all emotions, are distressing to the patient. The more recent trend in the radical treatment of parotid tumors has been toward the preservation of the facial nerve. This has been successfully accomplished by Garwardine, Gunn, Sistrunk, Adson, and others.

The parotid gland is more commonly invaded by tumors than any of the salivary glands and the most common growth is the mixed tumor. There has been no class of new growths that has given rise to so much controversy and yet remained so indefinite as that of the so-called mixed tumors. Keen states that they spring from a region containing diverse tissues, vessels, nerves, lymph, and secreting glands, making it difficult to be certain which tissue was primarily affected. Von Brun was the first to consider them epithelial in type and succeeding pathologists upheld his views and some classed them as carcinomas originating in the gland tissue. His researches on the pathogenesis of these tumors were very enlightening and prior to his splendid work erroneous theories existed as to their pathology.

In 1879 Wartmann advanced another theory which was ardently supported by Volkmann in 1895. They decided that these tumors are of endothelial origin arising from the endothelium of the blood vessels and lymphatics and called them endotheliomas. Golgi and Borst also described them under endotheliomas. Keen agrees with this view. He states:

The term endothelioma seems the best general one for mixed parotid tumors. It has been shown that cartilage formation and hyaline deposit, such as they contain, are typical of endothelial tumors in general, so that the term myxochondroendothelioma, sometimes applied to them, is histologically correct.

Billroth insisted upon their connective tissue genesis and considered them under the sarcomas and those containing hyaline cylinders

he called cylindromas. Koenigg and Kaufman described four types of parotid tumors; simple sarcomas, fibro sarcomas, myxo sarcomas, and chondro sarcomas. They stated that the four types may be found in one tumor, namely, mixed tumor. Da Costa believes that the so-called chondroma of the parotid gland is a mixed tumor springing from embryonic remains and practically always containing sarcomatous elements. He also states that any chondroma may become a sarcoma.

In 1903 Krompecher published an article describing these tumors as basal cell carcinomata. Marchand and Wilms considered them as composite tumors in which epithelium plays the most important part and regarded their origin analogous to that of the teratoma but undergo differentiation at a later stage. Landsteiner also considered the tumors to be of epithelial origin after finding epithelium and epithelial pearls in their structure. The epithelial theory was also accepted by Hinsberg, Wood, and Verhoef. Forgue considered them branchiogenic in origin and classed them as branchiomas derived from a branchial arch and adjacent furrows. He does not accept the older theories of epithelial and endothelial origin. Wilson and Willis concluded that these tumors are mesotheliomas arising from the mesoderm.

Fraser's experimental study of the neoplasm in the submaxillary gland of the dog led him to conclude that the mixed tumors arise from the ducts of adult glands. New does not agree with this view and believes that it is impossible to demonstrate any close connection, either grossly or microscopically, between the salivary gland and the tumor. He further states that the neoplasm in its early stage is surrounded by a definite capsule and, as a rule, is not in the gland, but in close proximity. Most of the modern pathologists are of the opinion that the mixed tumors arise from embryonic remains entirely foreign to the tissues in which they are found. They decline to accept an endothelial origin for cells that they consider are so obviously epithelial. New is an ardent supporter of this view, and McFarland agrees with him. He states:

The evidence most in favor of this view seems to be the fact that the tumors are adjacent to, upon, or in the parotid, but always most cleanly and clearly separated from it by a definite capsule, and that they never seem to contain distinct salivary gland tissue, though they always contain tissues having nothing to do with salivary glands.

Mixed tumors of the salivary glands arise from the mesoderm but there are other mixed tumors found in kidneys, breast, testicle, ovary, thyroid, and elsewhere which arise from the ectoderm and entoderm. These tumors may contain any type of cell which is found in the human body. McCallum tells us that it must not be supposed that

mixed tumors resemble each other in these different locations, but all they have in common is the principle upon which they are formed. Mallory states that mixed tumors differ from simple tumors in that the former arise from cells which have not attained full embryologic development and are capable of forming various kinds of cells while the latter arise from cells which have reached the end of their embryologic development and therefore they can form only one type of cell.

DIAGNOSIS

A mixed tumor in its incipient stage is a small, painless rounded or nodular mass usually found in the parotid region, less common in the submaxillary glands and seldom found in the sublinguals. In New's series of 68 cases, 50 of these tumors were of the parotid, 5 of the submaxillary, 1 of the sublingual, 4 of the pharynx, 1 of the larynx, 3 of the palate, 3 of the upper lip, and 1 of the cheek. Da Costa removed 3 similar tumors of the carotid gland, 2 of the nasopharynx, 1 of the tonsils, 1 of the superior maxillary bone, and 1 of the mammary gland. He considered them under endotheliomas and stated that it is not possible clinically to distinguish them with certainty from ordinary sarcomas.

AGE

The tumors are rarely discovered before adolescence. It is estimated that 50 per cent of them are noticed between the twentieth and fiftieth years but they may be discovered at any age.

GROWTH

The growth may be slow, rapid, or intermittent. In the 90 cases investigated by McFarland 14 grew slowly and continuously, in some the growth was scarcely to be noticed, and in 2 cases the tumor grew to the size of a grapefruit in 18 and 7 years, respectively. He emphasizes the point that acceleration of growth is no indication of a change from benignancy to malignancy and the microscopic examination of "quiescent" and "rapidly growing" tumor did not show substantial histological differences.

SIZE

These tumors vary in size from a small nodule which is barely visible to a mass twice as large as the patient's head. Conterill reported a case where the weight of the tumor was estimated at 26 pounds. It was not removed. Street removed one that weighed 7 pounds 3 ounces; Keen, one that weighed 7 pounds.

MALIGNANCY

Many consider them potentially malignant while others classed them as benign tumors. There is as much controversy as to their benignancy and malignancy as there is to their origin. McFarland insists that mixed tumors of the parotid must be regarded as benign in nature but he adds: "When the pre-operative duration of the tumor is less than 18 months and the section appears like carcinoma, the chances are that the tumor is carcinoma and will behave as one. These parotid tumors that are malignant and metastatic are malignant from the beginning—they do not become so." F. C. Wood states that the majority are benign. He estimates 25 per cent of these tumors become malignant.

IN SUPPORT OF MALIGNANCY

1. Thirty per cent of the tumors recur after removal. (McFarland.)
2. Some undergo necrosis, ulceration, and hemorrhage.
3. Some mixed tumors cause death by frequent recurrence and persistent growth no matter how early they are diagnosed and treated.
4. Mixed tumors with malignant change have been reported.

IN SUPPORT OF BENIGNANCY

1. They do not metastasize through the blood nor invade the lymph nodes like carcinomas and sarcomas.
2. Mixed tumors may exist for 50 years or grow to weigh 26 pounds in 22 years (Conterill's case).

The stethoscope was seldom used for the diagnosis of tumors yet Nelaton and Duplay have employed this method in the diagnosis of mixed tumors of the parotid. They called attention to a friction sound heard over the tumor when the patient opened and closed the mouth. This sound is probably produced by rubbing of cartilage which is a very common constituent of these tumors.

DIFFERENTIAL DIAGNOSIS

It is not possible clinically to differentiate between mixed tumors and other growths occurring in the parotid gland. The following tumors have been reported but are comparatively rare: Fibromata, lipomata, adenomata, chondromata, sarcomata, melanosarcomata, angiomas, rhabdomyomata, basal cell and prickle cell cancers, squamous cell epitheliomata, and cysts.

COMPLICATIONS

Mixed tumors of the parotid may undergo maglignant changes or may undergo cystic changes, necrosis, ulceration, and hemorrhage. They may involve the facial nerve and result in paralysis or involve the pharynx and cause dyspnœa and dysphagia.

ANATOMY

The facial nerve on emerging from the stylomastoid foramen runs forward in the substance of the parotid gland. The latter is located under the deep fascia below the zygomatic arch and between the ramus of the jaw in front and the external ear behind. Its lower lobes are wedged between the styloid process and the sternomastoid muscle. The gland is irregular and has extensions in various directions. Treves states that the facial nerve lies 1 inch deep to the mid-point of the anterior border of the mastoid process and that a line drawn horizontally forward from that point to the posterior border of the ascending ramus of the mandible marks the position of the main trunk of the nerve. The posterior belly of the digastric muscle serves as a guide, as the nerve is located immediately above it. After the facial nerve enters the substance of the parotid gland it runs forward superficial to the external carotid artery and the temporomaxillary vein which are also found in the substance of the gland. After passing these structures and while still in the gland the nerve divides behind the ramus of the mandible into two primary branches, temporofacial and cervicofacial. From these branches multiple offshoots diverge, giving the appearance of a "bird's claw" (*pes anserinus*).

The temporofacial branch is the largest of the two divisions. It passes upward and forward in the gland and after crossing the neck of the condyle of the mandible it gives its terminal branches—temporal, malar, and infraorbital. The cervicofacial branch passes obliquely downward and forward and opposite the angle of the mandible it gives three subbranches—buccal, supramandibular, and inframandibular. The latter branch is used as a landmark and therefore an accurate knowledge of its anatomy is essential. It is the first to be isolated and followed to a point where the nerve divides. The facial nerve is the chief motor nerve of the face.

OPERATION

Regional anæsthesia is the anæsthesia of choice, as the operation is rather long and tedious and requires careful and thorough dissection. Novocain solution to which epinephrin has been added makes

an ideal anæsthetic (one drop of 1 to 1,000 epinephrin solution to every 10 cubic centimeters of one-half of 1 per cent novocain solution). The epinephrin diminishes the bleeding in a field of operation so highly vascular and thereby facilitates the identification of structures.

Excision of the parotid gland in the radical treatment of parotid tumors is a difficult operation and its extirpation with preservation of the facial nerve renders the operation more difficult. But to save the patient from paralysis and great disfigurement is worth every effort, skill, and patience that the surgeon can give. Early diagnosis and early operation should be urged in every case. It is in this stage that we are reasonably certain to preserve the facial nerve and accomplish a permanent cure. In simple encapsulated mixed tumors, it is needless to say that their excision is simple and that the parotid should not be sacrificed. An attempt should be made to save the nerve in every case, whether incipient or far advanced. This can be successfully performed in all cases except those where the lines of cleavage have been completely obliterated and the nerve itself is involved. In such far-advanced cases any and all of the involved structures should be sacrificed. Complete removal of the tumor should be the first object to be considered. An incomplete excision is worse than useless.

Sistrunk emphasized the importance of exposing the facial nerve before excising the tumor. He isolates the inframandibular branch of this nerve near the angle of the jaw and follows it upward through the parotid gland to the pes anserinus. For the proper exposure of important structures in this region an adequate incision is very essential. Adson suggests a very satisfactory modification of the usual incision. His is a combination of two incisions. The first begins near the mastoid and extends downward and forward, 2 centimeters below the lower border of the mandible and ending 4 centimeters anterior to the angle of the jaw. The second incision begins below the zygoma and runs downward in front and close to the cartilage of the ear, just in front of the tragus down to a point below the lobule, where it curves backward and upward to join the first incision. Adjacent to the angle of the jaw and over the facial vessels, the inframandibular branch of the seventh nerve is first located and followed upward to the parotid gland. Dissection is carried through the gland until the cervical and temporal branches are free and the lower lobe is elevated. Prior to performing the last step, Adson prefers to carry the dissection from the zygoma downward, exposing the mandible, temporal vessels, and the posterior border of the masseter muscle and connecting this surgical field with that exposed by the cervical incision. The parotid is then elevated

and its duct is ligated and the mass excised, leaving the branches on the facial muscles undisturbed.

Probably the most difficult stage in the operation is the excision of the deep lobe of the parotid, which lies under the main branches of the facial nerve, and its deeper surface is in contact with the internal and external carotid arteries, the internal jugular vein, and the vagus and glossopharyngeal nerves. The facial nerve is elevated by means of narrow strips of rubber dam to avoid every possible injury and the dissection of the deep lobe is performed gently with a minimum amount of trauma. With gentle dissection the mass is carefully separated from the pharynx and temporo-maxillary joint, avoiding injury to the important structures lying underneath.

CASE REPORT

Case 1.—J. M. D. A Dominican laborer 45 years old, entered the hospital June 4, 1923, complaining of an unsightly tumor on the right side of face. It was first noticed 20 years ago as a small nodule below and in front of the right ear. Its growth was slow for 10 years, when it attained the size of a lemon. Eight years later he scarcely noticed any increase in size and thought that its growth came to an end. In the last two years it started growing again until it became the size of an orange. It is uncomfortable and unsightly but not painful.

Past history.—Gonorrhea in young adult life, typhoid fever at the age of 20, and malaria at 30. There is no history of cancer in his family.

Physical examination.—A well-developed adult male. General examination does not show any abnormality except in right side of face and neck. There is a tumor mass the size of an orange along the right side of the jaw below and in front of the right ear. It is a round, nodular, well-defined, hard, and partly movable mass. It is neither painful, congested, or inflamed. The overlying skin is not adherent to the mass. The external ear has been pushed outward and upward and appears out of shape. The external auditory meatus is compressed and obliterated. The pharyngeal wall on the affected side shows slight bulging. The tongue is large, heavy, deeply fissured, and thickly coated. The teeth are in bad condition and oral hygiene is very poor. The tonsils show slight evidence of chronic inflammation but are not enlarged. A friction sound was heard over the tumor when the patient opened and closed the mouth. There is no glandular enlargement in the neck or other parts of the body. There is no impairment in vision or hearing, no skin eruption, no arteriosclerotic changes and no abnormal changes in reflexes.

Blood pressure.—Systolic 136. Diastolic 85.

Laboratory examination.—Wassermann test, negative. Urine is negative. Blood count, coagulation time, and bleeding time are normal.

X-ray examination did not show any evidence of bone involvement.

June 25, 1923.—Operation was performed under local anæsthesia (novocain one-half of 1 per cent). The tumor and parotid gland were excised. The deeper lobe was carefully removed from the pharyngeal wall, and the important underlying structures and the facial nerve were preserved. Bleeding was controlled and wound closed in layers with a small drain placed in a dependent part of the incision which was removed the second day after operation.

Postoperative findings.—The tumor mass weighed 480 grams and appeared as if it had involved the parotid gland, although the lines of cleavage did not seem to have been obliterated.

Pathological diagnosis.—Mixed tumor of the parotid which contains considerable amount of cartilage.

Postoperative notes.—In spite of the fact that the facial nerve was preserved facial paralysis existed for three months. After that period paralysis subsided gradually and the facial muscles regained their motor power and tonicity, and one year from the date of operation there was no sign of paralysis whatsoever and no evidence of recurrence of the tumor.

Case 2.—J. B. World War veteran, age 42, entered the hospital September 6, 1927, complaining of a tumor on the right side of his face. He states that there never has been any pain or discomfort connected with the growth, but he wishes to have it removed for two reasons: First, he is fearful that the growth might change to cancer, and second, that it is unsightly and attracts the attention of others.

The growth was first noticed eight years ago. It began as a small nodule which has slowly increased in size with a more rapid increase in the last two years. During this period the patient was examined by various physicians who advised him against operation and explained its dangers and the possibility of paralysis.

Past history is unimportant and has no bearing on clinical history of the case.

The physical examination was negative except for the tumor on the right side of the face. The tumor is located anterior and inferior to the external ear. It extends three-fourths inch below the angle of the jaw and completely covers the ramus. It is oval in shape, being $3\frac{1}{2}$ inches vertical, $2\frac{1}{2}$ inches horizontal, and protrudes from the jaw about 2 inches.

The mass is fixed except for the lower pole but is not adherent to the bone. The overlying skin is at no point adherent to the mass. The latter is of the consistency of hard rubber with no palpable areas of softening or calcification. It lifts up the lobe of the ear and causes a marked anterior and inferior bulging of the external auditory canal. There is no tenderness on palpation and no redness or heat. A friction sound was heard over the tumor when the patient opened and closed the mouth. Oral hygiene is poor, pharyngeal walls appear normal and do not show any evidence of bulging. There is no glandular enlargement in the neck or other parts of the body. There is no impairment of vision or hearing and no abnormal changes in reflexes. Blood pressure: Systolic, 130; diastolic, 80.

Laboratory examination.—Wassermann test was negative; urine, negative; blood counts, normal.

X-ray examination did not show any evidence of bone involvement.

Operation.—September 9, 1927. Operation was performed under local anaesthesia (novocain, one-half per cent). The mass was completely excised and the facial nerve preserved. Wound closed in layers after bleeding was controlled. A small drain of gauze saturated with thrombo-plastin was placed in the most dependent part of the incision and removed the second day after the operation.

Operative findings.—Tumor weighed 300 grams, involved the whole gland except the deep lobe.

Pathologic diagnosis.—Mixed tumor of the parotid gland consisting largely of cartilagenous tissue.

Postoperative notes.—Convalescence was uneventful. There was no sign of paralysis even the day after operation. The wound healed without infection and



FIGURE 1.—BEFORE OPERATION. (SHAAR)



FIGURE 2.—ONE MONTH AFTER OPERATION. (SHAAR)

the cosmetic result was most satisfactory. Two weeks after operation the patient was given three X-ray doses of short-wave radiation at 10-day intervals. This radiation was directed to the right parotid region to minimize the possibility of recurrence. Fourteen months after the operation a message was received from the patient stating that there is no evidence of recurrence or paralysis and that he has been enjoying an excellent health.

SUMMARY AND CONCLUSION

1. The facial nerve can be preserved in the excision of parotid tumors even if the whole gland must be sacrificed.

2. To accomplish this procedure successfully in the great majority of the cases, early diagnosis and early operation should be urged.

3. Temporary paralysis may occur from trauma to the nerve during the operation, but it usually disappears within a year (Sistrunk).

4. In cases where the lines of cleavage have been completely obliterated or the nerve itself is involved it will be impossible to save it and should be sacrificed. An incomplete excision is worse than useless.

5. The possibility of facial paralysis should be explained to the patient before the operation.

6. Radium and X-ray treatments are not as successful as radical excision.

7. The parotid gland is more commonly invaded by tumors than any of the salivary glands, and the most common growth is the mixed tumor, the origin and malignancy of which has been repeatedly disputed.

8. The complex histology of the so-called mixed tumors led to the various theories that have been advanced in attempt to explain their origin. They were described under carcinomas, sarcomas, endotheliomas, myxochondroendotheliomas, adeno-chondromas, branchiomas, mesotheliomas, etc. Most pathologists are now of the opinion that mixed tumors arise from embryonic remains and consist of various types of epithelial and connective tissues and are usually identified by the presence of cartilage.

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ACUTE INFLUENZAL INFECTION, AN INTERPRETATION OF MILD RESPIRATORY DISEASES¹

By E. A. SHARP, Lieutenant Commander, Medical Corps, United States Navy

Several years ago Thomas Horder (1) asked the question: "Are there influenzas rather than influenza?" Up to the present time medical research has not vouchsafed an adequate answer. Therefore, still in pursuit of the solution, current nomenclature reflecting accepted clinical opinion is regarded as furnishing a premise for a pertinent discussion, although only controversial conclusions arise from it.

¹ From the United States Naval Hospital, Pearl Harbor, T. H.

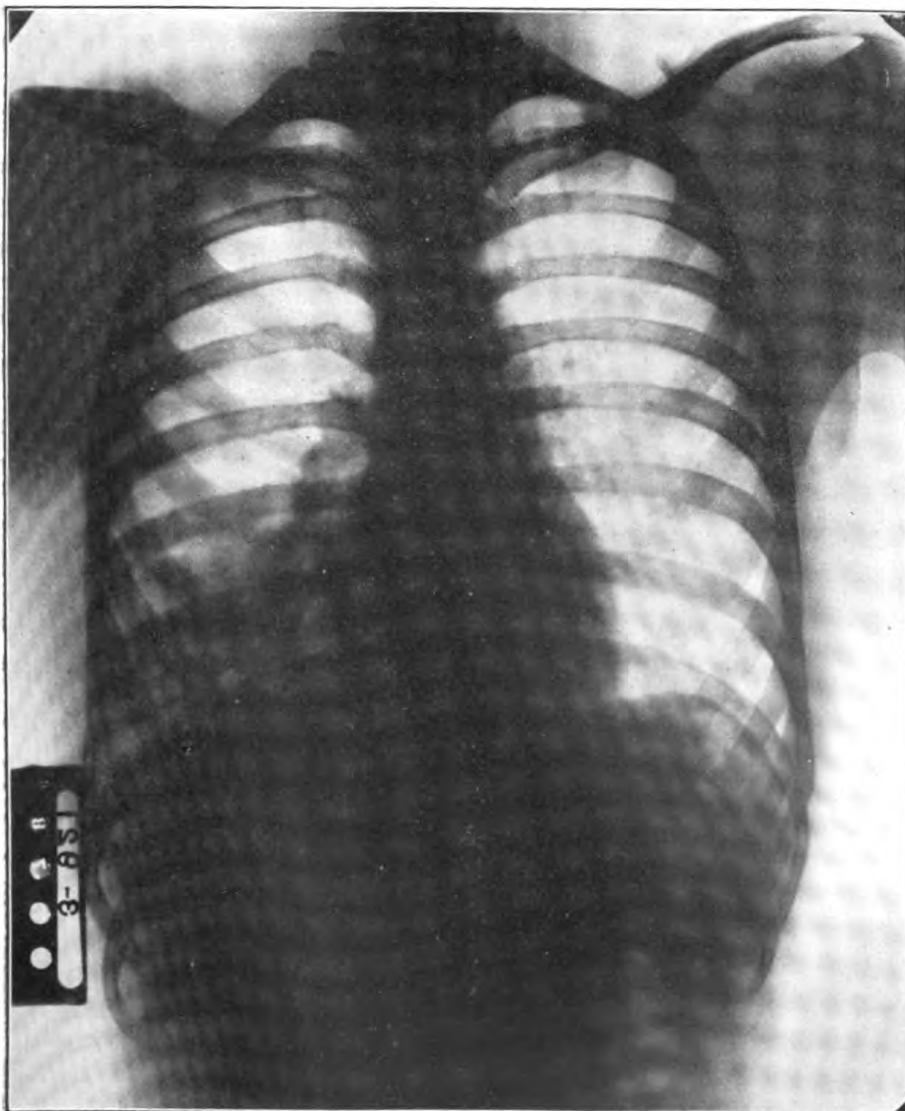


FIGURE 1 (CASE 1).—RÖNTGENOGRAM TAKEN FIVE DAYS AFTER ADMISSION
SHOWING AN AREA OF MOTTLING IN THE RIGHT LOWER LOBE OF THE
LUNG. (SHARP)

360-1

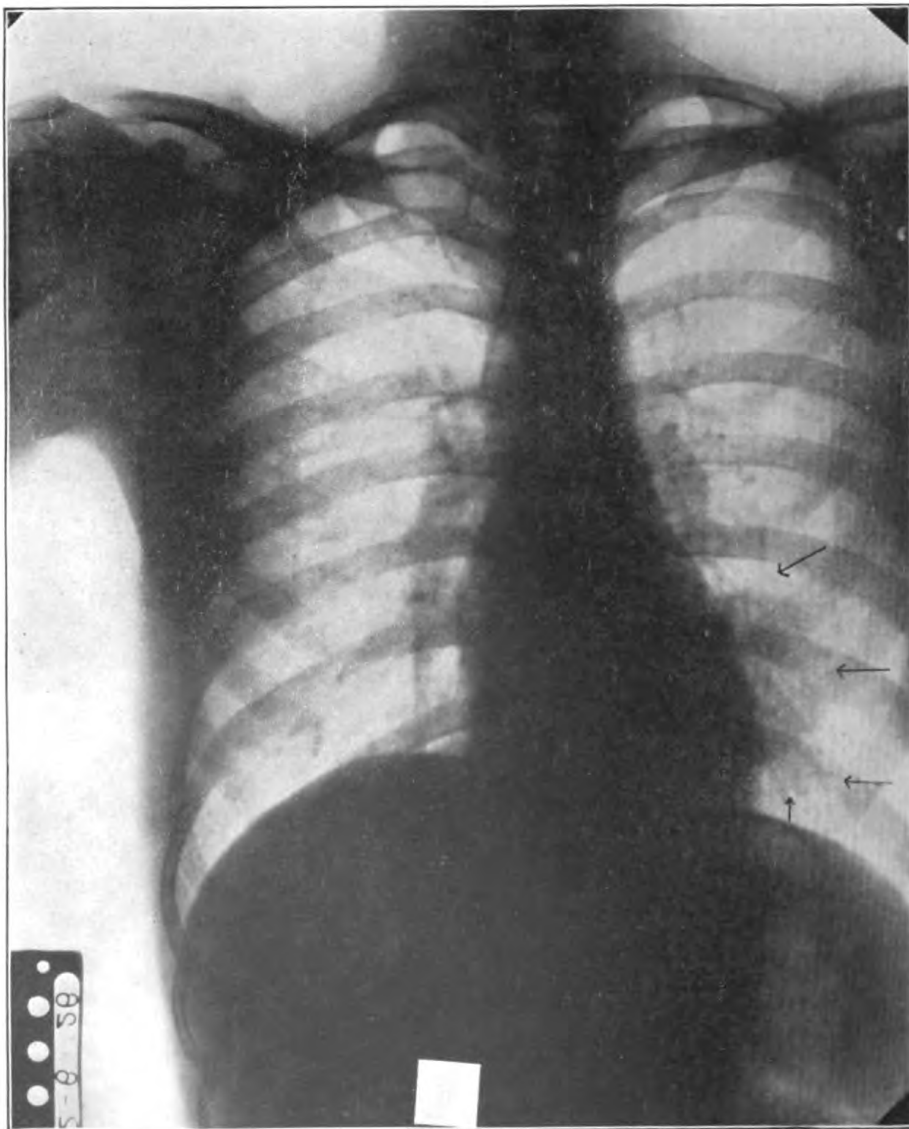


FIGURE 2 (CASE 2).—RÖNTGENOGRAM TAKEN SIX DAYS AFTER ADMISSION SHOWING A SMALL AREA OF INFILTRATION IN THE MESIAL THIRD OF THE LOWER LEFT LOBE OF THE LUNG. (SHARP)

360—2

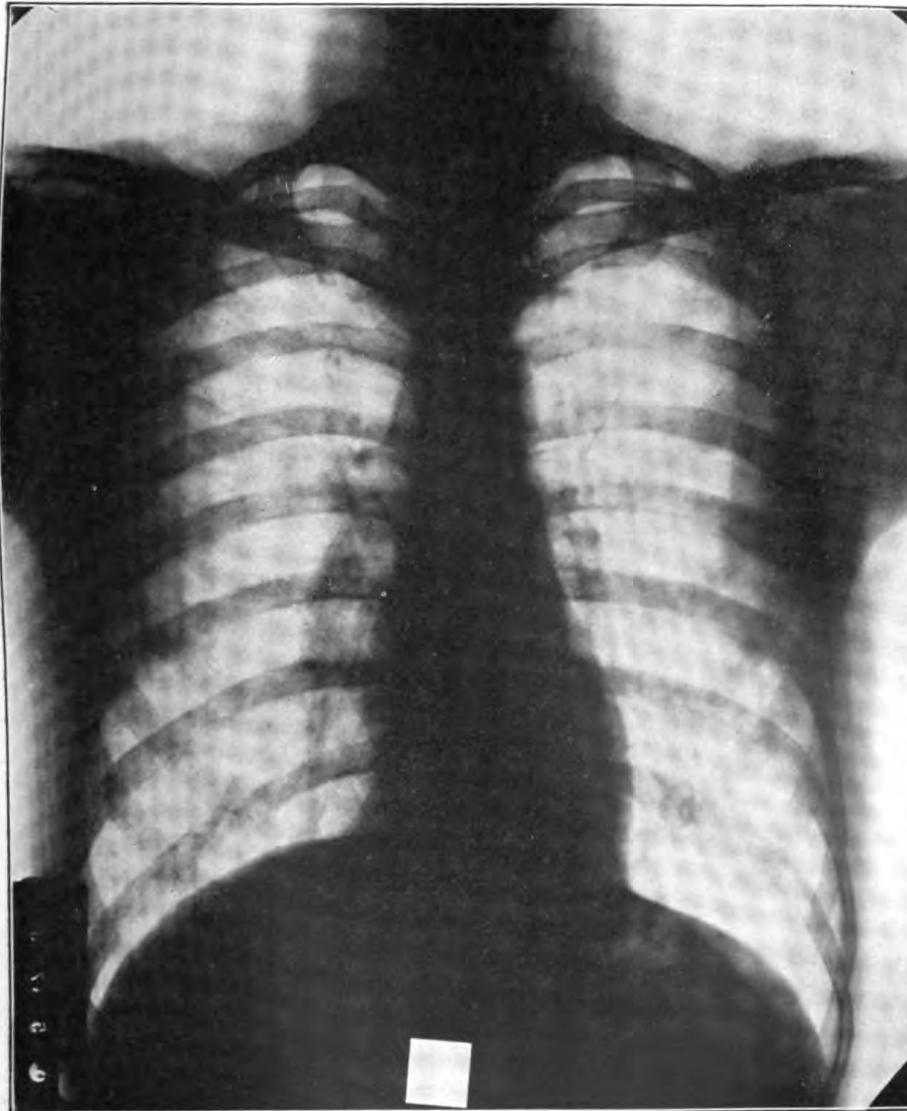


FIGURE 3 (CASE 2).—RÖNTGENOGRAM TAKEN 23 DAYS AFTER ADMISSION SHOWN FOR COMPARISON. THE AREA OF DENSITY IN THE LEFT LOWER LOBE IN FIGURE 2 IS ABSENT. (SHARP

360—3

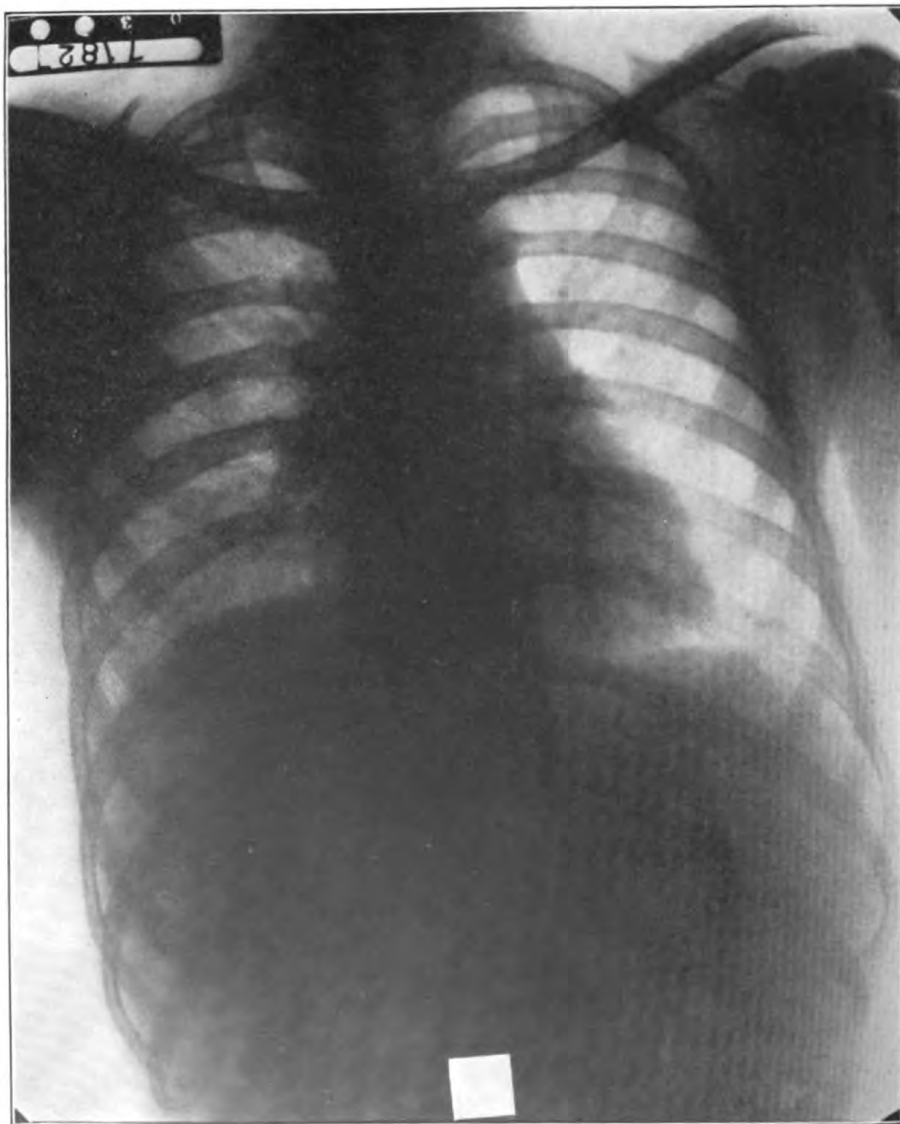


FIGURE 4 (CASE 4).—RÖNTGENOGRAM OF THE CHEST SIX DAYS AFTER THE ONSET OF RESPIRATORY INFECTION. THE ENTIRE RIGHT LUNG IS LESS RADIANT THEN THE LEFT. (SHARP)

360—4

INCIDENCE OF MILD RESPIRATORY DISEASES

In a consideration of respiratory disease a striking fact is obtained from the Annual Report of the Surgeon General of the United States Navy for the year 1927 (2). From a naval personnel of 113,756 there were 2,105 admissions for influenza resulting in 17,455 sick days; 5,310 admissions for acute catarrhal fever causing 31,825 sick days and 1,867 cases of acute bronchitis causing 18,965 sick days. The total number of patients in this group, 9,282, is approximately 8 per cent of the entire naval complement. The number of sick days for the three diseases reached an astonishing total of 68,245.

It is readily appreciated that conditions in a military service are not comparable to those of a civilian community. Nevertheless the existence of disease causing decreased man power is an economic loss—a factor secondary only in importance to the widespread physical suffering.

Personal observation of influenza during the pandemic of 1918–19, endemic-epidemics of respiratory diseases (probably influenza) in the years 1921, 1923, 1925, 1927, and in recent months (June and July) of 1928, has created these impressions: (1) The pandemic type of fulminating, hemorrhagic panpneumonitis is not encountered in the present day; (2) mild types of respiratory infection are still prevalent; (3) there are several clinical entities described as mild respiratory diseases, and (4) there is a lack of uniform clinical interpretation of the entities constituting the group.

The last point was well illustrated in a recent epidemic of respiratory infection occurring in this community. The staff of the naval hospital concluded that the disease was "influenza." In a civil hospital 10 miles distant it was called "acute upper respiratory infection" (3). At the same time many physicians reported cases of influenza to the local board of health. A comparison of case histories from the two institutions shows no point of difference to account for the divergent diagnostic view.

The case histories of 253 patients have been reviewed for the facts presented in this paper. The incidence of diseases considered to be of a mild respiratory character is shown by the admission diagnoses: Influenza, 160 cases, or about 63 per cent; acute catarrhal fever, 48 cases, or about 19 per cent; and 45 cases of acute bronchitis, or about 17 per cent. In order to emphasize the similarity of the salient features of the three types and to demonstrate difficulties of differential diagnosis four case reports are given in detail.

REPORT OF CASES

Case 1.—L. O. B., white, male, aged 24, single, private marine, was admitted to the hospital March 4, 1927, complaining of a "cold in his head."

Admission diagnosis.—Acute catarrhal fever.

Present history.—For the past 24 hours he had been having chilly sensations, cough, nasal discharge, headache, aching in back and legs, and general weakness.

Physical examination.—Normal, well-developed, and well-nourished man, with a deep injection of the scleræ of both eyes and an hyperemia of his nasal and pharyngeal mucosæ.

Laboratory observations.—Blood count: Leucocytes, 11,400; the differential was normal in a count of a hundred cells. The sputum did not contain any acid-fast bacilli; many diplococci and a few spirilla and bacilli were present. The Kahn reaction was negative. No ova or parasites were found in the feces. The urine was normal.

Course and duration.—The temperature, 102.5 F. on admission, descended by lysis to normal on the fourth day. The pulse rate and respirations did not exceed 85 and 20 per minute, respectively, at any time. This patient coughed considerably, produced small amounts of mucus, but otherwise was comfortable after his second day in the hospital.

March 9, 1927.—The Röntgenologist reported a resolving lobar pneumonia in the right lung base showing in the chest Röntgenogram.

During the next 10 days the patient's temperature was found to be 99.2 F. on several occasions, but on account of its irregularity, his excellent general physical condition, and his dislike for being kept in bed, he was allowed to be up and about on the seventeenth day after admission.

April 1, 1927, he was discharged from treatment.

Case. 2.—J. R. R., white, male, aged 22, single, private Marine, was admitted to the hospital November 30, 1926, complaining of chills, fever, sore throat, and headache.

Admission diagnosis.—Influenza.

Present history.—There was nothing to add to the symptoms enumerated in the admission complaints except that he was dizzy and had a severe cough without expectoration.

Physical examination.—Well-developed man of hyposthenic habitus. His face was flushed and there was a hyperemia of the pharyngeal mucosa. Auscultation of the lungs elicited harsh broncho-vesicular breathing in the upper and middle thirds of both lungs. No râles were heard. Heart was normal.

Laboratory observations.—Blood count: Leucocytes, 9,000; polymorphonuclears, 72 per cent; lymphocytes, 18 per cent; large mononuclears and transitionals, 8 per cent, and eosinophiles, 2 per cent. The sputum did not contain any acid-fast bacilli, but there were numerous groups of organisms morphologically *B. influenza* in specimens stained by Smith's stain.

Course and duration.—This patient suffered a great deal from cough, headache and backache, and pain in the upper abdomen. His temperature 103.2° F. on admission, came down to normal by lysis on the fifth day, but there was a rise that evening to 100° F. and it continued to show a slight elevation each day for the next 26 days. This patient was up and about part of the time during this febrile period. His appetite was impaired and he lost some weight. His headache and coughing persisted. Sputum, obtained in small amounts, was consistently mucous in character. The lungs were normal on auscultation.

December 6, 1926.—A Röntgenogram of the chest demonstrated an area of parenchymal infiltration in the left lung base.

January 10, 1927.—He was discharged from treatment on this date in good general physical condition. A Röntgenogram of his chest showed the lungs to be normal. This patient was reexamined several months later and found to be in good general physical condition.

Case 3.—W. H. T., white, male, aged 21, single, private marine, was admitted to the hospital, January 18, 1927, complaining of "cold in his head and chest."

Admission diagnosis.—Acute bronchitis.

Present illness.—This patient had a sudden onset of cough and general malaise the day before admission. Soreness in his throat developed about the time he began to cough. He had not had chills or pain in his chest. Upon admission his temperature was 100.5° F., pulse 85, and respirations 25 per minute.

Physical examination.—Well developed, underweight man of hyposthenic habitus. Skin clear. Scleræ of both eyes moderately injected. The pharyngeal mucosa was inflamed. Harsh rhonchi were heard in the central areas of both lungs by auscultation.

Laboratory observations.—Blood count: Erythrocytes, 5,670,000; leucocytes, 12,000; hemoglobin (Tallquist), 80 per cent; differential count of a hundred cells was normal. The sputum contained no acid fast bacilli and no predominating microorganism was reported.

Course and duration.—This patient was comfortable on the second day after admission. His temperature, pulse, and respiration had returned to normal. He still coughed and produced small amounts of mucus. No signs of lung involvement were found by auscultation or in the Röntgenogram; therefore he was allowed to be up and about January 22, 1927.

He continued to cough for the next three weeks, and his evening temperature was occasionally 99.2° F. during this time. He was observed for the next three months in the surgical ward. There was no recurrence of acute respiratory symptoms, but he did not feel well for six weeks, which could not be accounted for by his surgical condition of loose body in the knee joint.

Case 4.—H. S. M., white, male, aged 19, single, hospital corpsman, was admitted to the medical service, July 12, 1927, from the genito-urinary service, complaining of pain in the right side of his chest, cough, general aching, and sore throat of 24 hours' duration.

Past history.—He was under treatment in February, 1922, elsewhere for acute tonsillitis. An ulceration of the right tonsil developed and did not respond to ordinary treatment over a period of two months. Several positive Kahn reactions were obtained. Antisyphilitic treatment was followed by healing of the ulceration.

Present illness.—One month prior to the onset of the present complaint this patient was admitted to this hospital with an inflamed and enlarged right tonsil. It was considered to be a recurrence of the former tonsil infection. He was under antisyphilitic treatment at the time the acute respiratory symptoms developed.

Physical examination.—Well developed and nourished sthenic man. His right tonsil was enlarged and inflamed, but there was no ulceration or exudate. No areas of râles or dullness were found in the lungs. The breath sounds were diminished over the entire right lung.

Laboratory observations.—Blood count: Erythrocytes, 4,400,000; hemoglobin (Tallquist), 90 per cent; leucocytes, 9,000, with a normal differential. A blood culture showed no growth after 72 hours. The Widal reaction was negative. The Kahn reaction was weakly positive. No acid fast bacilli were found in the sputum. There were a trace of albumen, a few hyaline casts, and numerous pus cells in the urine.

Course and duration.—This patient continued to have an unproductive cough and pain in the right side of his chest for the next week after admission. His temperature was 104° F., pulse 110, and respiration 28 on the first day.

July 18, 1928.—Röntgenogram of the chest showed an opacity of the entire right lung field. The patient was still complaining of pain in the right side of his chest and had an unproductive cough. Breath sounds were distant. No râles or areas of dullness were found.

July 24, 1928.—The temperature came down by lysis to normal this date. An evening elevation of fever of one or two degrees continued for the next week. The patient felt much better. Röntgenogram of the chest showed the opacity of the right lung still present.

July 26, 1928.—No fluid was found after paracentesis of the right pleural cavity.

August 5, 1928.—Breath sounds were normal. The patient felt well and was allowed to be up and about.

September 1, 1928.—Tonsillectomy had been performed and he was returned to the genito-urinary service. A Röntgenogram showed a normal chest at this time.

DISCUSSION

Case 1 did not occur during an epidemic of respiratory infection, was mild in symptomatology, and in all particulars conformed to the clinical description of acute catarrhal fever. A lung involvement was found after the acute symptoms had subsided. The Röntgenogram of his chest showed an extensive area of mottling in the base of the right lung, which is not the homogenous consolidation observed in lobar pneumonia. However, it is typical of influenzal bronchopneumonia described by Landis (4) as out of all proportion in extent to other signs and symptoms.

Case 2 was admitted during an epidemic of influenza. His admission diagnosis was correct and his course and duration were not unusual. The small area of pneumonitis in the left lung was found by taking a series of Röntgenograms. It is believed that ordinarily one Röntgenogram is taken and a small infiltration is passed over by the Röntgenologist and clinician as "a slight increase in lung markings."

Case 3 is reported for the reason that this patient came from a unit having an epidemic respiratory infection regarded as influenza. For the reason that his constitutional reaction was marked and cough was severe he was sent to the hospital with a diagnosis of acute bronchitis. Although his acute symptoms subsided in about four days, his fever, cough, and general physical impairment persisted for several weeks. Influenza is believed to be a more rational discharge diagnosis than the one of acute catarrhal fever assigned to him.

Case 4 was a sporadic respiratory infection. Its onset, signs, symptoms, course, and duration are similar to influenza. The lung involvement might have been secondary to a focal infection in the

tonsil. However, the extensive bronchopneumonia with mild constitutional symptoms is suggestive of an influenzal character.

Acute catarrhal fever and influenza tend to occur epidemically. Influenza is alleged to produce the severer symptoms. Acute catarrhal fever is described as having a definite etiologic factor in *Micrococcus catarrhalis* (5). If accepted as fact, to confirm or disprove the diagnosis of "common cold" is possible. Also, if "acute upper respiratory infection" is accepted as a clinical entity it must be differentiated from influenza. The same is true for acute bronchitis, inasmuch as it is frequently employed as an admission diagnosis for epidemic and sporadic cases of mild respiratory infection.

TABLE 1.—*Epidemiological table of 253 cases of acute respiratory infection*

Diagnosis on admission	Number of cases admitted in epidemic periods	Number of cases admitted sporadically
Influenza.....	119	41
Acute catarrhal fever.....	34	14
Acute bronchitis.....	27	18

In an epidemiological study of acute respiratory infections, Bibb (6), has stated that: (1) Symptomatology does not differentiate influenza satisfactorily, and (2) a quiescent phase and an antagonistic phase tend to alternate with each other in the life history of facultative pathogenic bacteria. There is much evidence to support both statements.

An epidemiological chart of this small series of cases is shown in Table 1. Excepting minutæ of epidemiology these facts were obtained: (1) The greatest number of cases of respiratory infection for three consecutive years was admitted in periods from November to February and from May to July; (2) influenza predominated as an admission diagnosis; (3) differentiation of influenza, acute catarrhal fever, and acute bronchitis was made during the epidemic periods and in the sporadic group.

It is a well-established observation that an epidemic respiratory disease may coincidentally produce mild and severe manifestations. Are they gradations of one disease? Are the milder forms acute catarrhal fever, the severe ones influenza, and acute bronchitis a complication?

CONCLUSIONS

A primary cause of the diagnostic confusion is the profusion of clinical entities used in authoritative textbooks to describe similar mild respiratory infections.

Differential points are weakly based upon epidemicity and severity of the diseases for the reason that a precise gauge of individual susceptibility is not feasible, and further, a specific etiologic factor is not demonstrable in the test tube. An exact bacteriologic background once established will permit the full slate of medical nomenclature to be subjected to a desirable cleaning.

Didactic medicine has evolved and perpetuated "acute catarrhal fever," "influenza," "acute bronchitis," and "acute upper respiratory infection" in diagnostics to enable clinicians to label protean manifestations of acute respiratory disease not accounted for otherwise. If the titles are scientifically applicable to distinct affections, then, obviously they are indispensable. On the contrary, it can not be gainsaid that the diseases signalized by these terms possess fundamental criteria in common: (1) Similar phenomena of symptomatology and complications, and (2) obscure etiology.

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MECKEL'S DIVERTICULUM—A SURGICAL ANOMALY, WITH REPORT OF TWO CASES

By H. L. KELLEY, Commander, Medical Corps, United States Navy

Two cases where Meckel's diverticulum was the cause of surgical intervention have occurred at the United States Naval Hospital, San Diego, Calif., during the past year.

CASE REPORTS

Case 1.—R. R. C. G. M. Fleet Naval Reserve. Age, 59 years; weight, 189 pounds. Admitted in evening, July 30, 1923. Complaining of pain in right side of abdomen. No nausea or vomiting. Pain began 24 hours previously. Past history and family history unimportant, except that patient was in hospital nine days in January of this year with an attack of gastroenteritis which he attributed to eating some "sandwiches." Physical examination upon admission showed a well-built, well-nourished man of stated age. All symptoms point to abdomen, which is fat and protuberant. There is considerable rigidity which is not well made out on account of the obesity. There is tenderness over the right lower quadrant, and there is a "stabbing pain" when palpated deeply.

Temperature, 98; pulse, 66; respiration, 18; white blood count, 9,400; neutrophils, 73 per cent. Urine contained a trace of albumen.

The next morning, July 31, 1928, temperature, pulse, and respiration were normal. Soapsuds enema was effectual, but patient still complained of pain and tenderness in right lower quadrant and the indefinite rigidity persisted. It was therefore decided to operate, with the idea that the appendix was involved.

Operations.—Ethylene-ether; right rectus incision. The gall bladder and ducts were palpated and appeared normal. Toward the right iliac fossa the ileum was found to be adherent to the anterior abdominal wall, by moderate adhesions which were limited to a small area. When the adhesions were gently broken away the loop of intestine came into the wound. It was then seen that over an area 2 inches by 1 inch there was a local peritonitis with adhesions to adjacent intestine. In the center of this area there was a perforation with a foreign body protruding. This was removed easily and the perforation was closed by purse string suture. The foreign body proved to be a curved fishbone about 1½ inches long. (Upon inquiry of the patient, after operation, it was found that he had had fish for supper the third day prior to admission, and had swallowed a fishbone.)

The appendix was normal, but was removed. In getting the appendix up, a peculiar 3-way arrangement of the intestine was noticed about 18 inches above the ileo-cecal valve. Upon freeing some delicate adhesions there was found a pouch about 4 inches long having a blind end, and in this was the perforation which had been closed. Further examination, distal from the base of the pouch, disclosed a marked constriction of the bowel to a narrow tube about one-third of an inch in diameter. It seemed almost impossible that this could be the main passage of the gut, but no other lumen could be found.

There was some discussion at the time as to what should be done with this anomaly. Considering the age of the patient, and the absence of any history implicating this area previously, it was decided to leave it alone. The wound was closed with drainage.

Convalescence was uneventful except for a small fistula which closed in a few days. Bowels moved by enema on the second day and from the sixth day normally or by catharsis. He was up in wheel chair on the fifteenth day and discharged to home on the twenty-first day.

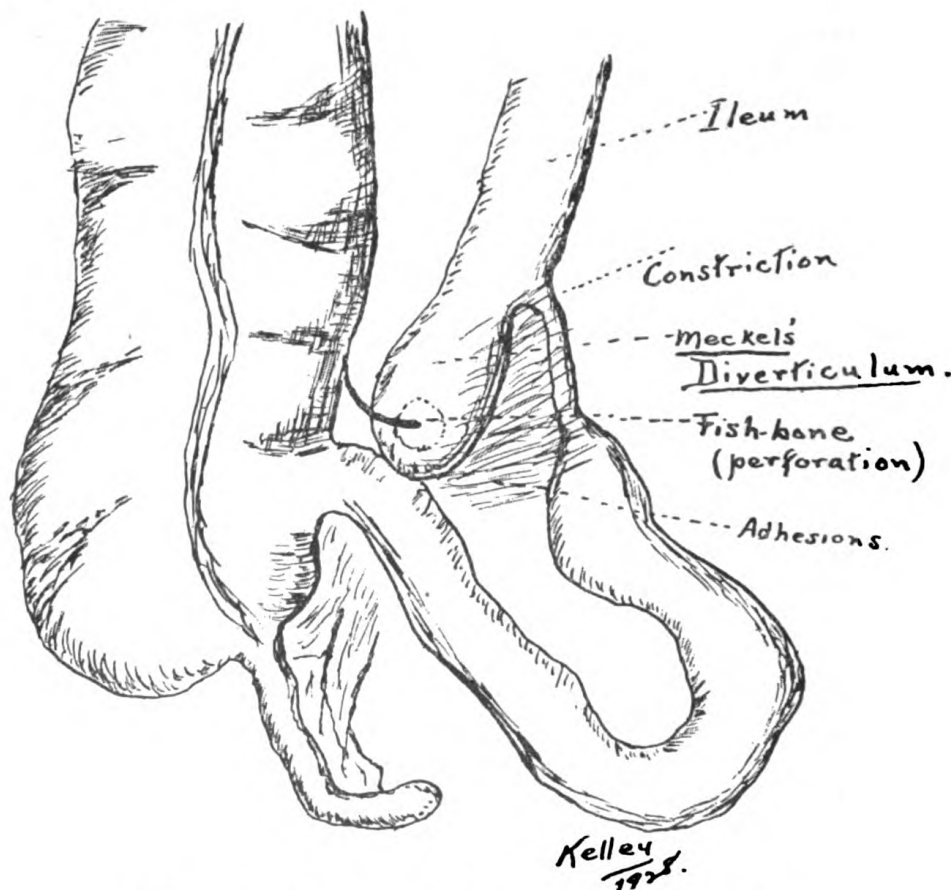
The sketchy diagram indicates, as well as may be, the condition found.

Case 2.—K. H. E., H. A. 2c, U. S. N. Age, 24 years; weight, 157 pounds. A member of the enlisted staff of the hospital and on duty as an operating-room assistant.

First admission, December 21, 1927.—Complaining of pain in epigastrium, radiating to a point a little to the right of the umbilicus. Slight nausea, but no vomiting. Slight tenderness to deep palpation over McBurney's point. No rigidity or rebound pain. Temperature, pulse, and respiration normal. White blood count, 9,100. Polys, 72 per cent. Urine, normal. To bed, nothing by mouth. Believed to have mild attack of appendicitis, operation advised, but patient desired to postpone operation until later. Since he would be readily available his wish was acceded to, and he was discharged to duty on December 24, 1927, at which time his white blood count was 7,350, polys, 65 per cent; no tenderness or other signs were present.

Second admission, January 18, 1928.—Sprain, one ankle, result of fall while at basket ball practice. X ray showed fracture, simple, third and fourth metatarsal bones, one foot. With the previous history of attacks of pain in the appendiceal area and the recent attack in mind, the patient was advised to have his operation, and convalesce from both conditions at the same time.

Accordingly he was operated upon on January 23, 1928. At operation a chronically inflamed appendix was removed; there were old adhesions from the former attacks. Near the appendix was a mass of intestinal loops which were matted together by delicate adhesions. These were separated and a 3-way arrangement of the lumen found. A pouch 3 or 4 inches long connected with the ileum at a point about 12 inches from the ileocecal valve. This appendage was subacutely inflamed and had been adherent to the surrounding structures. The diverticulum was removed and stump inverted. Wound closed without drainage. Convalescence was uneventful, and he was returned to duty on February 20, 1928.



Meckel's Diverticulum, with fishbone perforation. Case No. 1

In the literature at hand it is stated, by various authorities (1), that disease of this congenital anomaly is not common, although it may infrequently be the seat of an inflammatory process resembling appendicitis, or may be the cause of intestinal obstruction in one form or another. The last is especially true where the end of the diverticulum remains attached at the umbilicus.

In fact, it may be stated that Meckel's diverticulum, with or without disease, is not so frequently observed as to consider it of common occurrence; therefore it may be of sufficient interest to partially review the subject.

It will be recalled that Meckel's diverticulum was first described by Ruysch (2), but Meckel, in 1808, was the first to explain its origin from persistence of the omphalomesenteric (vitelline) duct. Normally this duct should disappear before birth, the attachment to the umbilicus should break away and atrophy, leaving nothing to indicate its former location.

The duct may, however, persist and form a part of the umbilical cord and may be recognized a few days after birth as a congenital fistula; or it may be found in the exploration of the abdomen during an operation or at autopsy. When present the diverticulum is from 2 to 25 centimeters in length and consists of a pouch contiguous with the small intestine and is situated from 4 centimeters to 4 meters above the ileocecal valve (3). It may be very difficult to recognize, owing to its resemblance to a part of normal intestine, and in ordinary surgical experience it will rarely be found, unless it becomes the seat of inflammation or causes obstruction by intussusception, strangulation, or volvulus.

It is stated that Meckel's diverticulum is found in about 2 per cent of bodies which come to autopsy (4). It is more common in males, and Keen gives the proportion as 100:30. Balfour observed this anomaly 15 times in 10,600 laparotomies at the Mayo Clinic. The writer has seen 5 Meckel's diverticula in about 2,500 abdominal operations; 2 of these were connected with the umbilicus by fibrous bands which had given no symptoms, 2 producing symptoms are reported above, 1 diverticulum was lying free in the abdomen and was discovered, by chance, while doing an appendectomy.

Porter (2) collected 184 cases in which Meckel's diverticulum was the cause of intestinal symptoms, including obstruction, intussusception, diverticulitis, perforation, and rupture of diverticulum. McFarland states that Forgue and Riche, in reviewing the subject, refer to a congenital stenosis of the intestine, occurring at a point corresponding to the former position of the vitelline duct and caused by its excessive atrophy. This stenosis was observed in one of our cases and an attempt is made to show it in the accompanying diagram.

Foreign bodies are infrequently found in Meckel's diverticulum and if present are rarely troublesome. The writer was able to find reports of three cases in which a fishbone was found. Two of these were reported by Cahier in a study of 35 cases of diverticula (5). In this series there were nine cases in which other foreign bodies, apple seeds, cherry stones, and coproliths were found. McFarland states that one case was reported by Hagler and Stewart, where Meckel's diverticulum was perforated by a fishbone.

Diagnosis.—There appear to be no definite symptoms or signs to enable one to establish a diagnosis of Meckel's diverticulum prior to

operation or autopsy. Such symptoms and signs as may be associated with pathology in this location are so simulated by other conditions affecting the area that differentiation can not be made. Diverticulitis, acute or chronic, simulates appendicitis, except that the tenderness, rigidity, etc., may be a little more to the midline, but this may also be true in appendicitis. Obstruction in this area, as well as volvulus, perforation, etc., can not be definitely located in a diverticulum except by direct visualization.

Treatment.—In general, it may be stated that whenever a Meckel's diverticulum is found it should be removed, unless other acute inflammatory conditions, age, or other necessity for terminating the operation, contraindicate such procedure. Since the diagnosis can not be accurately made one must be guided by the symptoms presented, pain, tenderness, nausea and vomiting, distention, possibly a tender mass near the umbilicus, fever, rapid pulse, blood count, etc, and one must conclude that there is present a serious intestinal derangement and must operate promptly. If appendicitis is suspected and a normal appendix found, search for a diverticulum should be made. If such be found the condition must be treated appropriately. The diverticulum should be excised and the stump turned in with sutures, bands which may cause obstruction must be removed, twists and intussusceptions reduced. Necrotic gut should be excised and proper anastomosis made and the abdomen drained when indicated. The after treatment is the same as for any similar procedure connected with another part of the intestine.

The mortality from diseased Meckel's diverticulum untreated is about 60 per cent. In cases promptly operated upon the mortality is about 10 per cent (4).

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OPERATIVE GYNECOLOGY IN THE TROPICS

A REPORT OF 100 CONSECUTIVE GYNECOLOGICAL OPERATIONS IN THE TROPICS

By L. H. WILLIAMS, Lieutenant Commander, Medical Corps, United States Navy

In reporting this series of gynecological operations in the Tropics the writer is aware that they may prove of interest to only those

few naval medical officers on special duty where gynecology is required. The operations are reported because of the variety of gynecological conditions encountered and for the interest they may contain for those readers who may find themselves, as was the writer, confronted with gynecological patients, with no specialists available to whom such cases could be referred.

The hundred consecutive gynecological operations herewith reported were performed at the Justinien Hospital, Cape Haitien, Haiti. They constitute approximately one-sixth of the general surgery performed during two years of duty as an officer of the public health service of Haiti. The operative procedures followed were all taken from standard textbooks and current surgical journals. Nine of these patients were Caucasians. Hysterectomies, suprapubic, accounted for 38 of the operations. Thirty-four were for myoma of the uterus, two for cancer of the cervix and two for prolapsus uteri. Myoma of the uterus is frequently encountered in negro women. The cause is unknown. One thinks of the prevalence of syphilis in this race and of concurrent adnexal disease from gonococcus infection. The percentage of positive Kahn tests in the patients operated upon for myoma was 30.8 per cent. Myoma of the uterus is a considerable source of disability among negro women and causes them to form a not inconsiderable number of surgical patients.

The methods of treatment for myoma, other than surgery, namely X ray and radium, are not available in Haiti. The claims of radiologists make strong appeal for this type of treatment, but it is not to be had at present here. Surgery is the only recourse available. In the treatment of myoma it has proved curative. Cancer is a different matter.

Before offering operation for myoma the operative mortality was taken into consideration. It was felt unfair to offer operations to patients whose general condition made the operation a hazardous procedure beyond the usual danger of such operations, or to those whose expectation of life would make it of little value. Accordingly, hysterectomy was advised only after preoperative treatment for existing syphilis, concurrent adnexal disease, intestinal parasites, amœbiasis, filariasis, malaria, and other diseases. Michael (6) has dwelt at length on the necessity for preoperative treatment in the Tropics. It is absolutely essential if one is to avoid a prohibitive mortality rate among the natives. Two exceptions to more thorough preoperative treatment and diagnosis resulted in two postoperative deaths of the total of three in this series. All occurred after hysterectomy. Pain unrelieved by opiates in moderate amounts was the reason for operation in these cases. Both were syphilitic, under treatment. One had pyelitis, but as we had no ureteral catheters at

the time that were stiff enough to enter ureters, treatment other than medical could not be done.

The myoma was very large and apparently was obstructing proper drainage. After operation, drainage was profuse from right kidney. The patient died of uremia two weeks after operation. The ureters were not damaged at operation, as was demonstrated at autopsy. The other died of peritonitis following a rupture of rectal wall. The rectum and sigmoid were firmly adherent to the myoma, and in addition the rectum was devitalized from severe syphilitic infection. Thrombosis of diseased and damaged vessels was in all probability the cause of the break through and resulting peritonitis. The third death was from embolism. This patient was also syphilitic, but had received considerable antisyphilitic treatment.

Ether was the anesthetic of choice in all hysterectomies. The advantages of spinal anesthesia in abdominal work were considered but rejected in this series. It will be tried in a later group as it has given us marked satisfaction when operating for other conditions. Stovain has been used so far here exclusively, with no unfavorable reactions. Novocain is claimed to be superior for spinal anesthesia by Pitkin (8).

Some of the hysterectomies for large myomata with adhesions to intestines, omentum, and adnexa seemed to offer more technical difficulty than the skill of the writer could cope with. In a few instances large cysts of the ovaries had to be excised before the vessels could be secured. In others, myomatous masses had to be cut away before the clamps could be properly placed. In others again, tubo-ovarian abscess formation had first to be taken care of. There were five cases with this complication. Submucous, subserous, intramural multiple myomata were all encountered, as well as polyps and areas of calcification in myomata.

Supravaginal hysterectomy was the procedure of choice. It was rarely found necessary to do more for simple myoma. Enucleation of myomata, a recognized procedure with eminent advocates, did not appeal as the operation of choice except for small tumors in women under 35. It was done in only two instances. One of these in an operation for tubo-ovarian disease, so listed in this series. The probabilities of other tumor nests is too great to be ignored in the patients seen here. The indication for hysterectomy in this group of patients with myoma were: Tumor and pain in 12; hemorrhage and tumor in 6; presence of a tumor in pelvis with no other complaint, 11; profuse discharge and tumor in patients past menopause, 3; bleeding and polyp formation with tumor, 2. Cystic degeneration proved to be the cause of discharge in two cases. In three hysterectomies for myoma, the myomatous condition was not

diagnosed prior to operation, which was determined upon because of chronic pelvic inflammatory disease with large tubo-ovarian abscesses.

Malignancy was kept in mind during operations for tumors of the uterus. Essen-Møller (2) states that Kelly found both myoma and cancer present twenty-eight times in 1,000 extirpations for myoma. No cancer was discovered in the myomatous uteri of this small series. Cancer of the cervix accounted for 2 of the 38 hysterectomies. These were panhysterectomies and included the vault of the vagina. The patients are alive after a year with no report of recurrence. Cancer of the cervix is not infrequently seen here, but these are the only two observed in the very early stage. The outcome so far has been very fortunate.

Dermoid cysts were encountered three times in the laparotomies reported. Only one was a separate operation. This was quite large and filled most of the abdominal cavity. It weighed 20 pounds and contained 20 teeth in addition to the usual hair and caseous material. A dermoid cyst the size of an English walnut was found in the wall of one myomatous uterus. It contained the usual material and hair. Another unusual thing was the removal of a calculus the size of a hazelnut from an ovary. The other ovary was excised because of extensive cyst formation.

Chronic endometritis and chronic endocervicitis were not as frequently treated by operation as they might have been with benefit to the patient suffering with this condition. Most of these individuals had a concomitant treponematoses infection, for which they had been admitted. The improvement following treatment for treponematoses was usually accompanied by a desire to be discharged before operation could be done. They had been improved by medical treatment and considered that enough.

One uterus was punctured in the process of curetting for persistent endometritis and metrorrhagia. There was also marked asthenia and retroversion of the uterus. The patient, a white woman, had been overlong in the Tropics. She was anemic and weak from prolonged and frequent menstrual periods. The uterine wall was very weak and friable. There was some shock noticed by the anesthetist at the time the curette entered the abdominal cavity. The uterus was packed, and the patient was quickly put in position for laparotomy. The puncture wound in vault of uterus was sutured, a Simpson type ventral suspension performed. The patient made an uneventful recovery and has regained her health.

Retroversion was operated upon in 10 patients. Three types of suspension were tried out in selected cases. The Baldy-Webster seemed the easiest technically. The Olshausen appealed. The Simp-

son is probably the best and is recommended by Graves (1). All of the patients operated upon for retroversion had negative Kahn tests. Perhaps just a coincidence in a small group. But contrasted with the 30.8 per cent for the hysterectomy group it may have some significance other than the fact that three of these suspension cases were upon white women and all of the hysterectomies were upon negroes.

Chronic pelvic inflammatory disease, gonococcus in origin, is a prolific cause of pain, disability, and sterility among native women of Haiti. Because of the prevalence of gonococcus infection here the women are frequently and early attacked. Many get over the acute stage with little to remind them of the infection except persistent leucorrhea or sterility. Others go on to chronic salpingitis, pyosalpinx, and tubo-ovarian abscess formation with adhesions to appendix, intestines and uterus. It is the practice here to treat acute salpingitis with rest in bed, ice to abdomen, catharsis, and mecurochrome and glucose intravenously in conjunction with intramuscular injection of milk. Acute cases rapidly subside under this treatment. Those not responding favorably are operated upon later. They appear to have less adhesions and less stormy postoperative course than patients not so treated. Black (3) states that operation in the acute stage, contrary to usual thought, is not inadvisable and that the patients so operated upon do well. It has proved advisable to remove both tubes when both are not patent. Not to do so in our experience has necessitated reoperation some months later with removal of the other tube. The tubes were always excised with a wedge-shaped portion of the uterus at the junction with uterus.

Ovaries were never removed unless so far destroyed by abscess formation or cysts as to be functionless, though Black (3), after an extensive experience in this type of surgery among negro women, states they can stand the loss of both ovaries extremely well. The appendix was removed along with diseased tubes. It was seldom seen uninvolved or nonadhered to tube or ovary in chronic pelvic inflammatory disease. There were 12 patients operated upon for this condition. The Kahn tests were positive in two, or 10.6 per cent. They were treated before and after operation for treponematosis and have proved very gratifying patients. Chronic pelvic inflammatory disease is so seldom treated at all in the country districts that nature accomplishes sometimes unusual effects in walling off and absorbing the inflammation products. In two patients, the enveloping and kindly omentum had failed to completely wall off the abscess which ruptured into the pelvis where the pus was confined. In these two patients (who were sisters), after a period of months, the pus burrowed through the parietal peritoneum and formed an abscess in the layers of the peritoneum.

In one sister, the older case, the pus had burrowed through the abdominal wall fasciæ and formed abscesses in the abdominal wall with sinuses through the skin. Collar-button abscesses were present throughout the different layers of peritoneum, muscles and fascia over the front of the abdomen below the umbilicus. Except for persistent leucorrhea, vaginal examination was negative save for tenderness and some resistance felt at vault of vagina. Temperature was 100; white blood count, 10,000; polys, 72 per cent. The condition as described had been present one year when patient was admitted to hospital. Excision of the three sinuses down to abscesses, the breaking through of intercommunicating sinuses, curetage of abscess walls, packing, and subsequent irrigation resulted in recovery. The younger sister had never menstruated. A tumor the size of a four months' pregnant uterus was present in the lower abdomen, midline position. This mass was hard and tender to both vaginal and abdominal palpation. The older sister said she had had a similar condition before the abscesses and sinuses formed in her abdominal wall. The abdominal wall of this younger sister was thickened and somewhat œdematous. Temperature, 99.5; white blood count, 10,500; polys, 76 per cent. Urine negative, vaginal smear negative for gonococci. Incision in midline under general anesthesia revealed a greatly thickened peritoneum, almost half an inch in thickness just above the pubis and thinning toward the umbilicus. Careful sharp dissection through this thickened and chronically inflamed tissue was rewarded by the distinctive colon odor and a small amount of thick pus. Further blunt dissection disclosed a sinus leading to an abscess over the bladder region. A finger introduced into this was followed by the outpouring of over a pint of pus. The abscess was drained. Healing was kindly and prompt. The tumor disappeared and menstruation came on before discharge from hospital. Both sisters have a history of an infection that could have been only gonococcus infection of vagina, cervix, and adnexa.

The need for perineoplasty was not found as frequently among the native negro women who had borne children as is found among an equal number of Caucasians. The reason is probably mode of life and racial. As this race gets more accustomed to easy living the women will probably succumb to the same post-partum ills as others. In Haiti nearly all births in the country districts are left to nature. A few native physicians give obstetrical care to those town patients able to pay for it. Women in the country districts who come to town with complications requiring the obstetrician's art usually die unless brought to the hospital early in labor before they are too heavily infected by native midwives. Hence the reason for the comparative scarcity of patients in need of perineoplasty. Five perineo-

plasties and colpoplasties were done in this series of gynecological operations. Three of them were upon negro women, two upon Caucasians. The last two were according to the method of Goff (4). This method is claimed to be an advance over older procedures and is as easy technically.

Prolapsus uteri in the advanced stage is not uncommonly met with. Most of the patients seen with this condition are well past 50 years of age and poor operative risks. The condition may be caused by myoma formation in conjunction with weakened uterine and vaginal wall supports, as proved to be the case in one of the patients upon whom an operation for procidentia was done in this series. There were three operations for this condition. The other two seemed to be simply a relaxation of uterus and vagina support. The operation for procidentia advised by Graves (1), was followed in two cases. It consists of perineoplasty, correction of cystocele, and rectocele and hysterectomy with ventral support of cervix and adnexa. The two cases made excellent recoveries. The third case was relieved by high amputation of cervix, perineoplasty, and ventral suspension of the small senile uterus. She also has done well.

Rectovaginal fistula, comparatively rare among Caucasians, is not infrequently seen here. It is usually seen in women heavily infected by treponema, with third-stage lesions. Stricture of the rectum is a frequent accompaniment. Childbirth seems to have little to do with causing the condition here. Untreated Bartholin gland abscess, which may go on to large size, and rupture into rectum, was the cause of the condition in one case operated upon here. The other was complicated by a very tight stricture of rectum. Kahn tests were negative in both cases, but both greatly improved under anti-syphilitic treatment.

Elephantiasis of the vulva is fairly common here. The cause is filaria in some instances and treponematoses in others. Filariasis is endemic here and undoubtedly elephantiasis of the vulva is more prevalent than usually believed. Unless the condition is distressing the women do not mention it. Several cases have been discovered in general physical examination. Vulvectomy, partial or complete, is the only thing that can be done. Bleeding is sometimes fairly profuse but easily controllable. Five patients were operated upon for this condition. The largest tumor mass removed was the size of a large orange. Both labia minora were involved in one patient. She presented a bizarre appearance. The vulva assumed an almost normal contour a short time after operation. Elephantiasis will recur unless all the involved tissue is removed.

Persistent bleeding after abortion and miscarriage accounted for six of the operations in this series, five of whom were Caucasians. One

patient had three abortions in two years. Her Kahn test was negative and she was clinically free from syphilis, kidney complications, or uterine displacement. Many of these patients came to the hospital in a moderate degree of exsanguination. Saline transfusion sufficed in conjunction with removal of retained products of conception and packing of uterus. There were no deaths among these patients.

Metrorrhagia and chronic endometritis accounted for the remaining 12 patients who were given only a dilatation of cervix and curetage. Kahn tests were negative in all these 18 patients.

Ectopic pregnancy was successfully operated upon in the only patient admitted with this condition. She was received on the fifth day after rupture of the right tube containing the foetal implantation. Red blood counts, 2,700,000; white blood counts, 5,000; temperature, 100; pulse, 120. There was the usual great amount of tympanites in such cases. As bleeding had apparently stopped it was decided to delay operation until some of the tympanites could be relieved. Three days after admission the patient complained of sharp cramp-like pains in the right lower abdomen and went into mild shock. She was given antishock treatment and operated upon under ether anesthesia. Considerable old free blood was found in the abdominal cavity and some fresh blood about the ruptured tube. The foetus of two and a half months' development was free in the abdomen save for attachment by the cord to the placenta still adherent to the tube. The tube and its contents were excised. Dilatation of the stomach and general tympanitis followed close upon operation and came near causing death of the patient. After frequent gastric lavage, magnesium sulphate enemata and transfusion of saline solution, recovery ensued with an uneventful convalescence. The Kahn test was positive. Spinal anesthesia advocates state this form of anesthesia is ideal for ectopic pregnancy operations. By it they claim the tympanitis is held to a minimum, besides the advantages of a quiet belly.

An interesting case in diagnosis was finally cleared up by laparotomy upon a young married multiparous Caucasian. This patient, a neurotic and underweight, complained of pain in abdomen over a 2-year period. Her physician thought she was suffering from chronic appendicitis. Her white blood count varied but was never under 10,500. Just before operation was decided upon it rose to 16,000; polys, 76 per cent; with temperature 99.5, pulse 100. There was a generalized tenderness over the abdomen, as severe in left lower quadrant as over appendix region. Incision in mid line revealed an old and firm adhesion stretched out to form a cord some 4 inches in length, from the omentum to the left ovary. The appendix was also

bound with adhesions. An explanation of her pain could be the pull on the adhesions about the appendix and the adhesion to the ovary from distention of the colon. There was no return of symptoms after operation and the patient gained 5 pounds in 2 months, though still rather neurotic.

A case of retained menstrual flow in a 14-year-old girl proved of interest. A tumor mass could be made out in the mid line and appeared to be that of a 4-month pregnant uterus. This mass projected well into the vagina. The anterior wall proved to be a tough thickened hymen. Incision into this allowed the escape of over a liter of chocolate-colored old blood. Normal menstruation followed in due time.

Two laparotomies disclosed inoperable conditions. One patient thought to have a myoma proved to be suffering from cancer of the body of the uterus with metastasis to bladder and broad ligaments. No operation for the condition was attempted. The other patient proved to have a myoma so firmly bound to small intestine and surrounding pelvic tissues that her condition precluded an attempt to extirpate the tumor mass. She recovered from the exploratory laparotomy and seemed well satisfied that no more was done. With more skill at the operator's command perhaps she could have been relieved successfully.

There were three cases of severe traumatism of the vulva treated during the time of this series. One was a large rapidly increasing hematoma that required laying open and tying of bleeding vessels. They are not listed as operations in this series as they were comparatively minor affairs from a surgical standpoint. All made excellent recoveries.

Two of the postoperative deaths could perhaps have been avoided, though it is questionable if they would have long survived their syphilitic infection, hampered as they were by the complicating multiple myomata. Certainly, with a more rigid selection of cases offered operation, the statistics for mortality would have been better. But while it is vitally important to prevent operative mortality by selection of cases where possible, it is believed one should not set too fast a rule under the conditions met with in Haiti. The aim in attempting these gynecological operations was to relieve these unfortunate native women of their disability and to free them and their compatriots of the fears and superstitions that have possessed them so long.

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AN UNUSUAL AMPUTATION

By J. C. ADAMS, Lieutenant Commander, Medical Corps, United States Navy

The case in question was that of a seaman who, while skylarking with shipmates, caught the middle and fourth finger of the right hand in the jamb of a door, with the result that the tip of the fourth finger was crushed and the middle finger was completely amputated through the distal interphalangeal joint.

The interesting complication in this case is the fact that the whole of the tendon of the flexor profundus digitorum was pulled away from its origin in the forearm and came away with the amputated portion of the finger. The patient apparently jerked away when the finger became caught, thus completing the amputation and tearing away the tendon. The tendinous portion attached to the stump of the finger measured 15 inches in length. (See photograph No. 1.)

The patient reported immediately to the sick bay for treatment. He was naturally in extreme pain. The wound disclosed a clean amputation with very little hemorrhage. It was of interest to observe that practically all pain was confined to the site of the amputation, practically no symptoms being referable to the forearm where the tendon had been parted.

In reviewing the anatomy of the parts affected, the four tendons of the flexor profundus digitorum spring from the common belly of the muscle in the forearm, which in turn has its origin from the upper three-fourths of the anterior and inner surface of the ulna. It also has an extensive origin from an aponeurosis springing from the upper three-fourths of the posterior border of the ulna, in common

with the extensor carpi ulnaris, and from the upper half of the interosseous membrane. The muscle separates in the lower forearm into the four flexor tendons, which after passing through the slit-like openings in the tendons of the flexor sublimis digitorum, reach their point of insertion, which is the base of the distal phalanx of the second, third, fourth, and fifth fingers.

In order for the tendon in question to have been torn out, it was parted at the site of its muscular origin, high up in the forearm, 15 inches distant from the site of amputation. This resulted in tearing and trauma of the muscular portion throughout its greater part in the forearm.

It is of particular interest to note that with the complete loss of this tendon the function of the remaining two joints of the affected finger is not impaired, flexion and extension being practically normal. This fact is readily explained when it is recalled that the flexor sublimis digitorum has its principal insertion into the base of the middle phalanx of the last four digits. (See photograph No. 2.)

ACROMEGALY

By C. P. KINDLEBERGER, Captain, Medical Corps, United States Navy

Nelson's Loose-Leaf Living Surgery gives a description of acromegaly, of which the following is a brief abstract.

Acromegaly is an abnormal development of the extremities associated with disease of the pituitary body or thyroid gland. Usually there are hypertrophy and hyperplasia of the anterior lobe of the pituitary. These are frequently accompanied by an increase in acidophil cells.

Skeletal changes depend upon the stage of ossification of the epiphyseal cartilages reached at the onset of the disease. Changes in the facial skull, the clavicles, the sternum, ribs, hands, and feet are characteristic and are familiar to all. Exostoses of the phalanges, shown in X-ray plates, may be an early evidence of the disease.

The skin changes are characteristic also. A coarse, wrinkled skin is commonly found. The sweat glands are enlarged and there is a tendency to hypertrichosis.

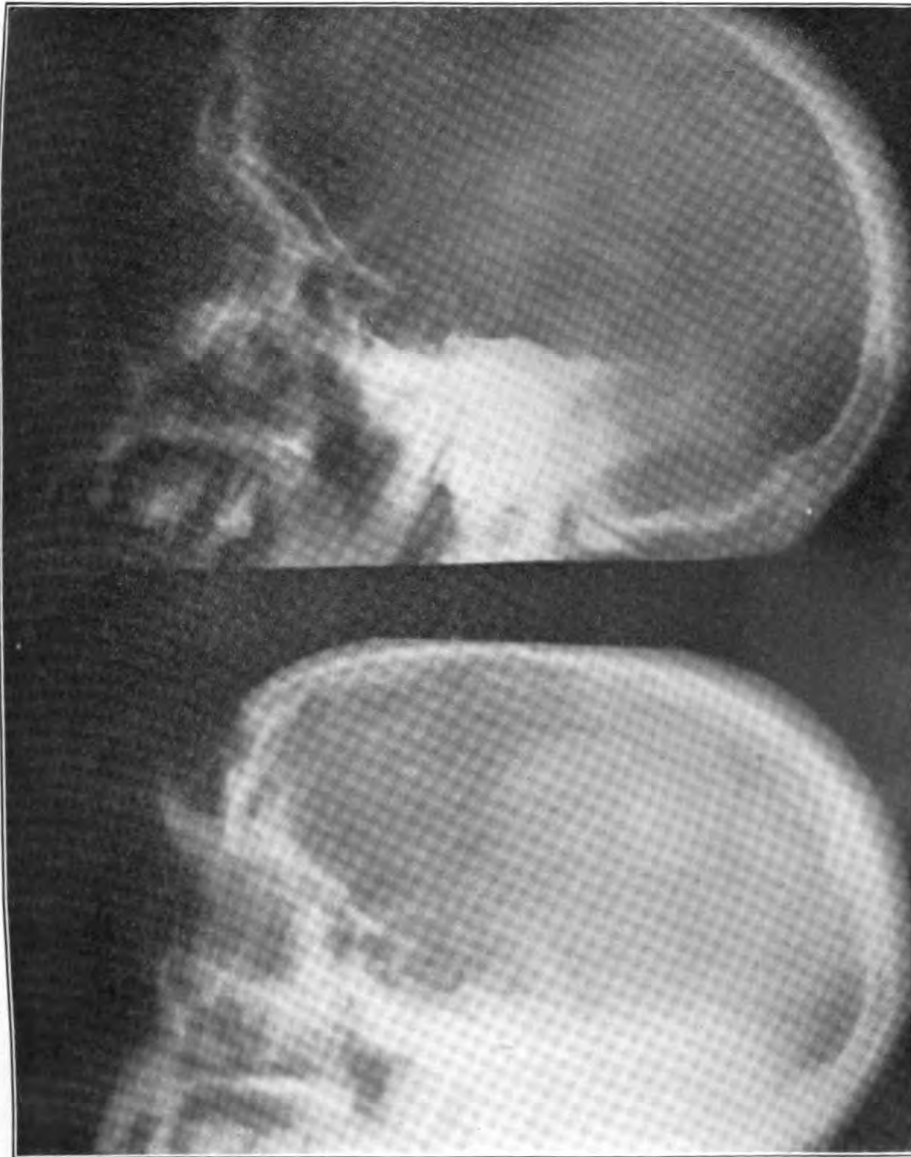
Glycosuria is usual in active cases.

REPORT OF CASE

G. J. N., engineer, second class, U. S. N.; age, 40. Readmitted January 21, 1927, from the U. S. S. *Chaumont*.

Chief complaint.—Swelling of hands and feet, with weakness and numbness. Is numb from hips down, legs very weak, staggers as he walks.

Family history.—Negative.



CASE OF ACROMEGALY. (KINDLEBERGER)

Past history.—Measles during childhood. Right hand injured when 12 years old. Venereal history negative. Alcohol, never to excess. Tobacco, moderate use all his life. Drugs, never used.

Present illness.—In May, 1925, first noticed hands getting large; not preceded by any nervous shocks, acute infections, etc. About December, 1925, feet started to swell and he noticed numbness from hips down; also in hands and arms. Changed size of shoes three times since then. Also had to buy a larger hat. No general symptoms—no symptoms of hyperthyroidism. In April, 1926, he started to feel general weakness and began staggering. Condition still progressive. Has always had a hoarse voice. No headaches; sleeps well. No trouble with eyes, ears, nose, or throat. No chest or cardiac symptoms. Skull typical of acromegalia. Marked enlargement of mandible and frontal bone. Nose and throat negative. Teeth, pyorrhea. Thyroid, not enlarged. Superficial lymph nodes, not enlarged. Chest: Some increased in anteroposterior diameter. Large lipoma between scapulæ. Blood pressure, 120/80; abdomen, negative. Lessened sexual desire and power. Extremities, hands and feet, typical of acromegalia. Reflexes diminished.

January 24, 1927: Kahn test, one plus.

January 26, 1927: X ray. The texture of the cancellous bone in hands is coarse and heavy and there is clubbing of the terminal phalanges. Skull: There is an overgrowth of the frontal bone giving the typical beetle brow appearance. The frontal sinuses are very large and the sella turcica is large and deep. The shadow between the clinoid processes suggests a tumor.

Ophthalmoscopic examination, negative.

Vision: 20/20, both eyes.

Muscles: Distance, $1\frac{1}{2}^{\circ}$ exophoria; 1° right hypophoria. Near, 9° exophoria.

January 28, 1927: Sugar tolerance test—

Blood sugar, before.....	milligrams per 100 cubic centimeters..	111
Blood sugar, 20 minutes after.....	do.....	133
Blood sugar, 40 minutes after.....	do.....	235
Blood sugar, 60 minutes after.....	do.....	236
Blood sugar, 120 minutes after.....	do.....	200
Urine, before.....	per cent..	None.
Urine, 20 minutes after.....	do.....	None.
Urine, 40 minutes after.....	do.....	0.52
Urine, 60 minutes after.....	do.....	1.5
Urine, 120 minutes after.....	do.....	1.6

January 28, 1927: X ray of skull shows sella turcica very much enlarged. No changes characteristic of malignant tumor; sugar tolerance decreased. Urine and Kahn test, negative. X ray of chest, negative.

January 31, 1927: Kahn test, negative.

February 5, 1927: X ray of heart; the 2-meter heart film is negative.

March 1, 1927. X-ray treatment once a week, but hands and feet are still slowly enlarging. Patient is a little weaker.

April 18, 1927: A board of medical survey met and recommended that patient be retained for further treatment.

April 30, 1927: Recommendation of board of medical survey approved. Patient's condition slowly progressing.

May 15, 1927: Enlargement of lower jaw noted. Incisor teeth separated and anterior to those of upper jaw. Some pain in hands. Can now barely wear a No. $8\frac{1}{2}$ shoe. Gradually getting weaker and increased numbness noted.

May 18, 1927: Sugar tolerance test:

Blood sugar—	Urine per cent
Before, 71.4 milligrams per 100 cubic centimeters.....	negative.
20 minutes after, 95.2 milligrams per 100 cubic centimeters.....	0.35
40 minutes after, 125 milligrams per 100 cubic centimeters.....	1.7
60 minutes after, 117.6 milligrams per 100 cubic centimeters.....	1.7
120 minutes after, 68.9 milligrams per 100 cubic centimeters.....	2.5

May 23, 1927: X ray of skull. The sella turcica has the same appearance as in previous films. Otherwise condition continues about the same.

June 14, 1927: Case progressing, feet and hands larger. Right arm very weak. Occasional trace of sugar in urine. Complains of bitemporal headaches, burning in character but only when in the sun or when lying on his back.

June 27, 1927: Knees beginning to swell. No glycosuria,

July 7, 1927: Blood sugar, milligrams per 100 cubic centimeters, 363.6.

July 18, 1927: No contraction of visual fields. Glycosuria at last examination. Otherwise the same.

July 23, 1927: Case is apparently slowly progressing. Glycosuria almost constant. Recommended for medical survey, this date.

July 28, 1927: Basal metabolism, +7 per cent. Weight, 154 pounds. Blood sugar, milligrams per 100 cubic centimeters, 166.

August 1, 1927: Same, excepting that he now complains of feeling as if packed in ice from the hips down.

August 8, 1927: Numbness returned to legs and feet. Right foot enlarged.

August 18, 1927: Recommendation of board of medical survey approved. Condition slowly progressing; hands, feet, and ears enlarging. Muscular weakness of legs increased. Headaches relieved somewhat. No eye symptoms.

September 15, 1927: Weight, 162½ pounds. Urine, sugar free.

September 28, 1927: Patient quite depressed, not much change in condition. Weight, 158 pounds.

October 17, 1927: Weight, 161 pounds. Feet larger. New bone formation at external occipital protuberance.

November 16, 1927: Invalided from the service, on approved medical survey. Condition the same.

REPORT OF AN EPIDEMIC OF DYSENTERY

By W. D. DAVIS, Lieutenant Commander, Medical Corps, United States Navy

Since February 22, 1928, seventy-six cases of bacillary dysentery have developed on the naval reservation at Olongapo, P. I., with a mortality of 30.26 per cent. There were 2 cases in February, none in March, 2 in April, 5 in May, 1 in June, 44 in July, and 22 from August 1 to 20.

All of the above cases have been among the native population except one. All of the 23 deaths occurred in children under 4 years of age except two who were 8 years and 6½ years of age. Eight of these cases received no treatment and 11 received no treatment until after the fourth day of the disease.

All of the cases except 12 developed in the town of Olongapo; 45 per cent of the cases developed on Draper Street, which is a water-front street.

The population on the naval reservation is about 6,000 people scattered in 12 barrios. There is no doctor on the reservation other than the naval medical officer. The town of Olongapo, which is on the reservation, is only a few feet above sea level and during extreme high tide most of the streets and lower floors of the buildings are covered with water. The streets have open cement drains which are flushed by fire hose once a week. During high tide the water backs up into this drainage system. The houses are not equipped with toilets, but at the end of each short cross-town street public toilets are maintained.

The people are very careless, and feces can often be found in alleys and on the streets where it is thrown. The toilets are filthy unless a constant inspection is made. The sewers from the public toilets run into the bay, but on Draper Street they are built out on small piers so that at low tide the open end of the sewer is 3 to 4 feet above the water. The wind carries the spray from the running sewer to the houses along the beach. These sewers are now being extended so that they will be below the water at low tide.

The water supply of the town comes from a creek about 4 miles away. There is a dam across the stream and the amount of water is sufficient throughout the dry season. The water is not filtered, and during the wet season at times is muddy. Bacteriologic examination revealed a bacteria count of 27,450 per cubic centimeter, but no colon bacilli were found. The watershed is guarded and no one is allowed in the hills above the dam.

The medical officer makes daily inspections of the town of Olongapo. The people are made to sweep the alleys and keep the streets clean. There are very few flies on the reservation. Many of the people are superstitious and still believe in witch doctors. They will hide cases of sickness and have been caught carrying very sick children out of the back door as we go in the front, and then deny any sickness exists in the house. In several instances dysentery cases have been moved to other Provinces at night to avoid being detected.

When the present epidemic appeared the following sanitary measures were taken. A letter addressed to the people telling them of the dangers of dysentery and how it is spread, with special emphasis on the following points, was distributed throughout the reservation:

- (a) Cleanliness in handling food.
- (b) Killing flies and keeping flies from food.

- (c) Importance of reporting early every case of dysentery.
- (d) Air bedding—utilizing sunlight.
- (e) Use distilled or boiled water for drinking purposes.
- (f) Cleanliness of hands.

This notice was translated into Tagalog and 1,000 copies distributed through the schools and placed on bulletin boards. A special detail of three civilian workmen was assigned to cleaning and disinfecting toilets. The families where cases of dysentery developed were vaccinated with dysentery vaccine. Later, when sufficient vaccine was procured, all those applying were vaccinated free of charge. All cases of dysentery were removed to the town hospital as soon as detected.

Two of the three corps men on duty at the dispensary and one nurse from the town hospital were detailed to make a house-to-house canvas looking for dysentery cases. An order was issued directing the people to report immediately any cases of diarrhea or dysentery to the reservation medical officer at the Camilla Simpson Hospital, Olongapo. The marines detailed as patrolmen were instructed to keep people off the beach near open sewers and to report any cases of sickness discovered. Since the above precautions have been taken there has been a gradual decline in the number of new cases.

SYMPTOMS

Seven per cent of the cases gave a history of headache followed by a severe chill and fever with one or two soft bowel movements, followed in 12 hours by frequent stools consisting of small amounts of mucus, pus, and blood. The other cases gave a history of frequent stools consisting of mucus and blood, followed by fever. In many of these cases the griping pain was not severe and often did not appear until after 12 hours of the onset of the disease. Headache was a frequent symptom but vomiting was rare. Tenderness over the colon was present in practically all cases. Toxic symptoms were more marked in the young children.

The blood count showed a moderate leukocytosis of fifteen to sixteen thousand. The stools consisted of mucopus and blood. Microscopically stools were rich in polymorphonuclear leukocytes, red blood cells, and some macrophages. Twenty-three of the stools (30.25 per cent) showed ascaris ova, 12 showed trichuris, and 9 strongyloids. Five of the cases also had malaria and six were complicated with whooping cough.

In the age groups there were no cases under 1 year but 48½ per cent under 5 years of age.

(Dysentery cases, grouped by ages)

Age	Number	Per cent	Deaths
1 to 5 years.....	37	48.5	21
5 to 10 years.....	20	24.6	2
10 to 20 years.....	10	13.4	0
20 to 30 years.....	4	5.2	0
30 to 40 years.....	0	0	0
40 to 50 years.....	1	1.3	0
50 to 60 years.....	1	1.3	0
60 to 70 years.....	3	3.9	0

TREATMENT

General patients were put to bed. If the symptoms had appeared within the past 12 hours a dose of castor oil was given. The diet for the first 24 hours was albumin water and forced liquids. After the first 24 hours thin gruels were given, then orange juice, poached eggs, crackers, and double-baked potato was gradually added. Sodium sulphate in saturated solution was given in 1-drachm doses every two or three hours to the toxic cases. Serum therapy gave very good results in all but four cases.

The average amount of antidysenteric serum required by each patient was 85 cubic centimeters. The amount required by adults was usually less than that required by children, probably due to the greater natural resistance of adults. The serum was diluted with an equal amount of normal saline and given intravenously to all cases over 5 years old. It was given by intramuscular injection in younger children.

VACCINATION

The vaccine used was the dysentery polyvalent vaccine supplied by the Bureau of Science at Manila. All contacts were given two injections of dysentery polyvalent vaccine. All others who applied were also furnished this vaccine. The adult dose was 0.5 cubic centimeters for the first injection and 1 cubic centimeter for the second.

Eight hundred and two people received one inoculation but only 405 received two injections. The results of the vaccination were somewhat disappointing as is shown in Table No. 2.

TABLE 2.—*Patients developing dysentery after first and second inoculation of dysentery polyvalent vaccine*

Case	Age (years)	Day symptoms developed	Result
E. M.....	6½	Third day after first inoculation.....	Well.
C. M.....	12	Second day after first inoculation.....	Do.
O. A.....	23	Twenty days after second inoculation.....	Do.
P. M.....	5½	First day after first inoculation.....	Died.
P. R.....	9	Second day after second inoculation.....	Well.
A. A.....	6½	Thirty-seven days after second inoculation.....	Died.
E. I.....	20	Fifteen days after second inoculation.....	Well.
B. N.....	8	First day after first inoculation.....	Do.
L. D.....	5	Second day after first inoculation.....	Do.
F. M.....	6	Sixth day after second inoculation.....	Do.
E. P.....	20	Seventh day after first inoculation.....	Do.
Q. E.....	9	Nineteen days after second inoculation.....	Do.
A. P.....	2	First day after first inoculation.....	Do.
F. E.....	13	Eighteen days after second inoculation.....	Do.

Fourteen cases developed after one or two inoculations of the dysentery polyvalent vaccine. Seven of these cases received two inoculations but developed the disease from 2 to 37 days after the second injection. In the above series two died, and the symptoms of the other cases were in no way modified by the vaccine.

In one case a child, age 2 years, was given 10 cubic centimeters of antidysenteric serum as a prophylactic measure, as her two brothers had dysentery and the mother had to take care of all three children. This child remained well for 12 days, but then developed a severe attack of dysentery.

CONCLUSION

The mortality from bacillary dysentery among this series of cases was 30.26 per cent. All of these deaths were among children under 8 years of age. Sixty-five per cent of all cases developing dysentery under 5 years of age died. Of the 23 cases that died, 8 received no treatment and 11 received no treatment until after the fourth day of the disease.

The antidysenteric serum should be given early and in large doses. Intravenous injections give better results than intramuscular injections. Vaccination with the polyvalent serum is of doubtful value, and in this series of cases did not modify the severity of the disease.

ANTIMONY AND POTASSIUM TARTRATE IN TREPONEMATOSIS

By L. H. WILLIAMS, Lieutenant Commander, Medical Corps, United States Navy

It is difficult to find a finer chapter in the history of naval tropical medicine than the attack upon the treponematoses infection of the inhabitants of the tropical islands belonging to the United States and those countries with whom treaties stipulate a State medical service supervised by the Medical Corps of the Navy. The struggle first attained prominence in the Pacific just after the war with Spain, when the natives of Guam were rescued from the frightful disease.

The armamentarium of the pioneers in treponematoses therapy was the time-honored treatment of syphilis with mercury and iodides, reinforced in a few years by the newly discovered salvarsan of Ehrlich.

With the military occupation of Santo Domingo and Haiti in 1915 the corps was again confronted with a similar, though much larger problem. The people of Haiti, descendants of African slaves, were heavily infected with the disease in its various stages. Scarcely a family group in the country districts could be found with all of its members free of the disease in the infectious stage. Approximately 80 per cent of the inhabitants gave positive Wassermann reactions. The inhabitants of the towns, except the upper class, were in little better condition.

The task confronting the newly established State medical service, called for by the treaty with Haiti, was almost overwhelming in the face of the difficulties to be overcome. These in the main, consisted of a population of some 2,000,000 people, the majority of whom were suffering from some stage of treponematosi infection, and who were suspicious of the newcomers and hostile to change. They were intensely ignorant, living in isolated huts or hamlets reached by roads and trails only passable on foot or horseback.

Very little money was available and the political situation necessitated the expenditure of most of it in the sanitation of the few towns of the country. It was not until 1919, the World War over, that it became possible to devote the personnel and money necessary to make even an impression upon the disease in the bulk of the population. However, the effort of the first years was not wasted; steady progress was made and the confidence of the people slowly gained. There was built up a nucleus of cured and benefited individuals here and there over the country, who proved of great value when quiet and peace was secured, and it became possible to hold clinics in the country districts. These became general in 1923 and 1924.

To the remedies formerly in use against the spirochetes, namely, mercury, potassium iodide, and the arsenical compounds, salvarsan, neosalvarsan, and sulpharsphenamine, there was added in 1925 the bismuth salt, sodium potassium bismutho tartrate. Because of its cheapness, ease of administration, and effectiveness, its use soon largely superseded that of other remedies in the country clinics. In the Cape Haitien district of the National Public Health Service there were administered 184,071 intramuscular injections of this drug during the fiscal year October, 1927, to October, 1928. The hospitalized patients of the district suffering with treponematosi received 10,136 intravenous treatments of neosalvarsan. Both clinic and hospital patients received daily treatment with "specific mixture," composed of potassium iodide and bichloride of mercury.

With these remedies, the doctor confronted with the problem of a population suffering with treponematosi can be confident of success, with persistent treatment in the majority of cases.

But there remains a type of lesion which does not respond beyond a certain stage of healing to these recognized effective remedies. These lesions consist of skin ulcerations of varying size and depth. Some may be so large as to include half the leg surface and to reach to the bones; others may be of only pin-head size. In spite of treatment thoroughly persisted in, these lesions fail to heal. The individuals affected bear the signs of early yaws infection. The Kahn test is frequently negative. They are salvarsan fast, so to speak. Most of them have been treated extensively in past years with mercury, potassium iodide, neosalvarsan, and bismosol, and their general

condition greatly improved. But their skin ulcerations have not completely healed, or having healed have broken down again. They present a source of public expense, as nearly all such individuals are indigent.

In the effort to completely cure these people, after other measures, such as curretage of ulcers, strapping, undercutting, dressing with various ointments, mercurochrome, or S. T. 37 had failed to more than improve temporarily the condition, intravenous injections of antimony and potassium tartrate were used. Because of the known spirocheticidal properties of this drug, and its value in the treatment of granuloma inguinale as described by Fox (1), we determined to give it a thorough trial. There were some 25 patients in the hospital with these apparently incurable yaws lesions at the time.

The dosage recommended seemed large and fraught with danger. We approached the matter cautiously but soon found that the average adult individual was capable of tolerating 10 cubic centimeters of a 1 per cent solution twice weekly without untoward symptoms. An occasional patient exhibited signs of overdoses, namely, irritability, coughing, headache, nausea, and vomiting, which disappeared on cessation of administration of the large dosage. Substitution of a smaller amount did not bring on a return of symptoms.

Diligent search for Donovan bodies in these cases before and during treatment failed to reveal any of these parasites. Whether our technique was faulty we have not been able to determine. The majority of the lesions showed a contaminating spirochete and bacterial infection. The spirochetes disappeared from the lesions after a few tartar emetic injections.

The time necessary to secure healing over of the ulcerations varied. No time prognosis could be made in individual cases. Some individuals received as many as 20 intravenous injections. They were started with 3 cubic centimeters of a 1 per cent solution in distilled water and increased 1 cubic centimeter per injection to 10 cubic centimeters. Injections were given twice weekly.

Every lesion so treated did not respond favorably to treatment. In several cases there was no response at all. In others, improvement for a time followed by breaking down of lesions. Some control cases, in which normal saline compress dressings were used, seemed to do equally as well. But there were enough cures in the series of 200 patients, namely, 20 per cent, to make us feel that the intravenous administration of a 1 per cent solution of tartar emetic, in these long standing, Kahn fast, apparently incurable ulcerations was an advance over other methods of treatment and worthy of continuation.

REFERENCE

1. Fox, HOWARD: Granuloma inguinale: Its Occurrence in the United States. J. A. M. A. 87, 1785. Nov. 27, 1926.

NAVAL RESERVE

Naval Reserve Officers will find the following letter of the Chief of the Bureau of Navigation of interest. It indicates the growing importance of individual officers in the Navy Reserve.

Nav-164-G
QR/P11-1/OM(248)

NAVY DEPARTMENT,
BUREAU OF NAVIGATION,
Washington, D. C., November 14, 1928.

From: Chief of the Bureau of Navigation.

To: Commandants, First, Third, Fourth, Fifth, Ninth, Eleventh, Twelfth, and Thirteenth Naval Districts, and Commandant, Navy Yard, Washington, D. C.

Subject: Proposed course of instruction for medical officers of the Naval Reserve in connection with original physical examinations for flying.

1. It is desired to send a limited number of Naval Reserve Medical Officers to Washington, D. C., San Diego, Calif., and Great Lakes, Ill., for two weeks' training duty with pay, including mileage, for special instruction in connection with original physical examinations for flying. It is essential that officers taking this course be ophthalmologists.

2. If there are not already in the Naval Reserve ophthalmologists desiring to take this course, the commandant is requested to nominate to the department, for appointment in MC-V(S) of the Naval Reserve ophthalmologists, up to the number indicated below, who would be willing to perform this training duty and to conduct such physical examinations involving flying of Naval Reservists, as may be required in their vicinity, without further cost to the Government. Those designated for the course should, therefore, as far as practicable, reside in localities at which aviation squadrons or divisions of the Naval Reserve are maintained.

3. It is desired that these officers report on June 1 for two weeks' training duty at the stations indicated below:

Those to be sent to the Naval Medical School, Washington, D. C.—

First Naval District, 2 from the vicinity of Boston.

Third Naval District, 2 from the vicinity of New York.

Fourth Naval District, 1 from the vicinity of Philadelphia.

Fifth Naval District, 1 from the vicinity of Norfolk.

District of Columbia, 1 from the vicinity of Washington.

Those to be sent to the Naval Training Station, Great Lakes, Ill.—

Ninth Naval District, 1 from the vicinity of Detroit.

Ninth Naval District, 1 from the vicinity of Great Lakes.

Ninth Naval District, 1 from the vicinity of Minneapolis.

Ninth Naval District, 1 from the vicinity of St. Louis.

Those to be sent to the Naval Air Station, San Diego, Calif.—

Eleventh Naval District, 1 from the vicinity of Long Beach.

Twelfth Naval District, 1 from the vicinity of Oakland.

Thirteenth Naval District, 1 from the vicinity of Seattle.

4. The bureau's records indicate that no increase will be necessary in the authorized training quota of officers to any of the districts in order to accomplish the foregoing. Should additional funds be required under subhead 1 of the Naval Reserve appropriation in connection with the mileage involved, request for additional allotment should be made therefor.

5. It is desired that the Bureau of Medicine and Surgery be notified as to the officers selected for this training so that reading references may be forwarded for theoretical indoctrination before reporting for practical instruction.

R. H. LEIGH.

The following is the list of reading references mentioned in the above letter:

REFERENCES ON PERSONALITY ANALYSIS

Hart: Psychology of Insanity. Cambridge University Press.

White: Mental Hygiene of the Child. Little, Brown & Co.

White: Mechanism of Character Formation. MacMillan Co.

MacDougal: Outline of Psychology. Scribner & Sons.

Tansley: The New Psychology. Dodd, Mead & Co.

Amsden: A Guide to the Descriptive Study of the Personality. Reprint of American Journal of Psychiatry.

Kretchmer: Physique and Character. Harcourt, Brace & Co.

Berman: The Glands Regulating Personality. MacMillan Co.

Timme: Endocrinology. Paul Hoeber Co.

Bagby: The Psychology of Personality. Holt & Co.

Bauer: Aviation Medicine. Williams & Wilkins Co.

Noyes: Psychiatry for Nurses. MacMillan Co.

New appointments in Naval Reserve

Name	Rank	Class	Appointed
Beal, Homer Albert.....	Lieutenant.....	MC-V (S).....	Oct. 20, 1928
Brown, Irwin Schilling.....	do.....	MC-V (S).....	Oct. 17, 1928
Canon, Robert Travis.....	Lieutenant commander.....	MC-V (G).....	Dec. 31, 1928
Congdon, Charles Bennett.....	Lieutenant (junior grade).....	MC-V (G).....	Nov. 7, 1928
Dalrymple, Sidney C.....	Lieutenant commander.....	MC-V (S).....	Oct. 17, 1928
Engel, Lawrence Power.....	Lieutenant.....	MC-V (S).....	Dec. 6, 1928
Green, Joseph Sidney.....	Lieutenant (junior grade).....	MC-V (G).....	Nov. 20, 1928
Greer, Joseph Madison.....	Lieutenant commander.....	MC-V (S).....	Oct. 29, 1928
Helwig, Ferdinand C.....	Lieutenant.....	MC-V (S).....	Oct. 30, 1928
Klatt, Emil Henry.....	Lieutenant (junior grade).....	MC-V (G).....	Oct. 16, 1928
Kracke, Roy Rachford.....	do.....	MC-V (G).....	Oct. 20, 1928
Lappin, John Joseph.....	do.....	MC-V (G).....	Dec. 12, 1928
Luckey, Robert Garlock.....	do.....	MC-V (G).....	Oct. 17, 1928
Payne, De Walt.....	do.....	MC-V (G).....	Nov. 20, 1928
Sale, John Judson.....	Lieutenant.....	MC-V (S).....	Oct. 20, 1928
Schaffer, Howard William.....	do.....	MC-V (S).....	Nov. 12, 1928
Smith, Wallace Bruce.....	Lieutenant commander.....	MC-V (S).....	Dec. 1, 1928
Spies, John W.....	Lieutenant (junior grade).....	MC-V (G).....	Nov. 13, 1928
Stofer, Dar Delos.....	Lieutenant.....	MC-V (S).....	Nov. 9, 1928
Thomas, George Clair.....	do.....	MC-V (G).....	Oct. 25, 1928
Wagoner, George W.....	do.....	MC-V (S).....	Dec. 14, 1928
Willhelmy, Ellis Warner.....	do.....	MC-V (S).....	Nov. 19, 1928

Promoted

Name	To—	Class	Date
McCarthy, Donald.....	Lieutenant commander.....	MC-V (G).....	Oct. 24, 1928
Sinamark, Andrew.....	do.....	MC-V (G).....	Nov. 1, 1928

NURSE CORPS

THE ART OF ANESTHESIA

By ETHELYN S. EVERMAN, Nurse, United States Navy

The history of anesthesia is divided into two periods, the pre-anesthetic period and the anesthetic period. The preanesthetic period ends and the anesthetic period begins with the discovery of ether in 1842 and with its general introduction as an anesthetic for surgical operations in 1846.

Anesthesia has been used since earliest antiquity. This has been proven from references made by many writers, even as far back as Homer in his "Odyssey," and Pliny, the Roman author, in 23 A. D. speaks of the juice of certain leaves being taken before cuttings and burnings to produce sleep. In 1772, Priestly discovered nitrous oxide, and about 1842 the fumes of ether became very popular for their exhilarating effects. Medical students indulged in what were known as "ether frolics." The fumes were inhaled until a state of excitement was reached and at times the victim would pass into a state of unconsciousness.

Nitrous oxide was used as an anesthetic in 1844 and foreshadowed the use of nitrous oxide-oxygen in 1846. The first successful operation under ether was performed in 1846 at the Massachusetts General Hospital. Since these early experiments with ether and nitrous oxide-oxygen as anesthetic agents, we have reached to-day a period where the administration of an anesthetic has become a scientific procedure, with a minimum amount of danger to the patient.

The proper administration of an anesthetic is more than a mere mechanical performance; it is an art. The art of anesthesia is acquired by becoming familiar with the laws which govern its administration, and by developing the ability to properly correlate and apply these laws. Experience only brings with it dexterity, tact, and skill. Each individual is a law unto himself when it becomes a question of how to handle that individual under an anesthetic. There is a code of rules and symptoms laid down to be followed in giving an anesthetic. These rules are plastic, however, and must be made to fit the peculiar demands of each individual who comes as an anesthetic risk. So the anesthetist, as she becomes more experi-

enced, should always be more careful. She should try to formulate laws and these she should strive to prove by the next case.

"Sizing up the patient" is a common expression used by the anesthetist. In that expression many things are included some of which are:

1. The physical build of the patient.
2. Complexion of patient; is he ruddy skinned, sallow, anemic, or jaundiced? Note skin reflex, color of lips, nails, ears, and conjunctiva.
3. Count pulse, note rate, rhythm, and volume.
4. Note abnormalities as short thick neck, large tongue, false teeth, glass eye, etc.
5. Note eye reaction, type of eyeball, and injury to eye.
6. Note swelling around throat such as enlarged thyroid, sarcoma, or enlarged tonsils.
7. Note cough, coryza, dyspnea, asthma, etc.
8. Note patient's mental attitude.

The mental attitude of the patient brings us to the thought of the patient's point of view. It always pays the anesthetist to be able to put herself, figuratively speaking, in the patient's place. Many people have a hazy idea of hospitals in general, and especially operating rooms and the administration of anesthetics. We have a patient coming to us from the ward, obviously scared, wondering just what is going to happen to him and knowing he must take an anesthetic and lose consciousness. Perhaps this is to be his first experience. He is nervous and excited and vainly tries to hide and overcome these emotions. A few kind reassuring words, spoken at this time by the anesthetist, with a smile, goes a long way toward calming his fears. Asking him questions about himself and feeling his pulse will help him become more at ease and relaxed. An effort to make him as comfortable as possible on the hard operating table is appreciated. If the anesthetic is started in a leisurely fashion, showing consideration for the patient in every possible way, the anesthetist will receive her reward in the majority of cases, by having a smooth induction which in turn paves the way for a smooth period of maintenance. The anesthetist who has the tact and personality necessary to win the patient's confidence, has increased her chances of giving a satisfactory anesthetic from the standpoint of the surgeon, patient, and anesthetist.

The signs of anesthesia may be considered under five headings: Respiratory; color; muscular; eye; and pulse. During the periods of excitement and rigidity, we are concerned with the first two, respiration and color. As anesthesia progresses, the muscular signs become of value, later the eye signs, and last the pulse. The respira-

tion and color must be under satisfactory control throughout the anesthetic and especially during the period of induction. The others, during the induction, serve to show that the patient is not under the control of the anesthetic. As the anesthetic progresses, however, the muscular signs, the eye signs, and the pulse become of positive value, helping to determine the level of anesthesia to which we have brought the patient. The most important single sign of this group is the respiration. One should be intimately acquainted with the normal respiration and should be able to detect any deviation from the normal limits by the sound alone. All of these signs just mentioned will, of course, show different characteristics according to the anesthetic agent used and the method of administration.

The anesthetics used mostly to-day are ether, administered by the open drop, the semiopen or the closed methods, and gas oxygen, which is used very extensively for a large number of cases when complete relaxation is not needed. The gas-oxygen, ether sequence is used more than any other combination where complete abdominal relaxation is desired. Other anesthetics are used to a lesser extent, the main ones being ethyl chloride, chloroform, and ethylene gas.

Attached to every gas-oxygen machine there should be a tank of carbon dioxide, 10 per cent, with oxygen, 90 per cent. This gas is being used with great success as a respiratory stimulant. In all gas-oxygen anesthetics, we have a percentage of rebreathing which, in the majority of cases, provides the necessary amount of carbon dioxide in the blood and will keep the respirations reasonably full. But in extreme cases, where the respirations remain very shallow, carbon dioxide administered with oxygen in a 10 per cent plus 90 per cent mixture will usually bring about, in a very few minutes, a full, deep respiration.

Gas-oxygen anaesthesia is always administered through a machine and is considered the most difficult of all anesthetics to administer. Usually the patient becomes unconscious in from 40 to 50 seconds. The field of anesthesia is shallow so that the desired level is difficult to hold unless there is constant watching of the symptoms shown by the patient, and quick control of the mixture the patient is taking. From the point of view of the patient, this method is the most satisfactory yet devised. Aftersymptoms are conspicuous by their absence and the patient is not often sick, though there may be some retching. Complete consciousness returns in from one to four minutes after stopping the anesthetic.

Ethylene gas is more or less popular for two reasons, it gives a little better color and it gives more relaxation than is obtained by nitrous oxide. The general rules for administering ethylene gas are about the same as in gas oxygen with about the same symptoms,

except that there is not so much cyanosis. Its greatest drawback as an anesthetic is its explosibility. All static is eliminated in the machine by grounding it and static must be eliminated in the anesthetist also. This is done by touching the patient before turning on the machine. Ether must be administered, in addition, in a certain per cent of cases.

Chloroform and ethyl chloride are not used extensively to-day as general anesthetic agents.

The choice of anesthetic to be used usually rests with the surgeon. In his selection, he takes into consideration the diagnosis, age and general condition of the patient, any complications present, whether a complete general anesthetic or an incomplete anesthetic is necessary, and the character of the operation to be performed. It is generally admitted that ether still holds the highest place as the safest and best complete general anesthetic.

If there is any book which might prove valuable to a nurse before starting a course in anesthesia, I would recommend *Art of Anesthesia*, by Dr. J. P. Flagg. A little preliminary practical experience along with the study of the book would be a great help to the average person contemplating taking a course in instruction in anesthesia.

WHAT PSYCHOLOGY IS AND DOES¹

THE SUBJECT MATTER, ITS PROBLEMS AND METHODS

Psychology is derived from the Greek words, *psychos*—meaning mind or soul; and *logus*—meaning science or theory. By derivation and ancient usage, we know that the word means “the science of the mind and soul,” which can only be more strictly defined by the analysis of what the mind means. In the natural sciences, the subject matter and scope are so evident that little preliminary discussion is called for, as the methods of scientific investigation have proven exceedingly fruitful in this field. But with psychology, however, much is freed from metaphysics. This field is different. The human individual becomes the main object of study, and being so complex an object it was doubtful before the nineteenth century whether there ever could be a real science here. In the beginning of the nineteenth century, after much study had been done in such fields as biology and physiology, the work of the investigators was so successful that to-day we have considerable knowledge and data which can be assembled under the title of “scientific psychology.”

¹ This is the first of a series of notes made by the nurses of the United States Naval Hospital, Norfolk, Va., and of the Pharmacist's Mates' School, Portsmouth, Va., from a course of lectures delivered before them by Dr. E. G. Fleming, associate professor of psychology at William and Mary College.

Psychology is then "the science of the mind or soul," "the science of consciousness," or "the science of behavior," which is the most recent attempt at a definition by the behaviorists.

"It is what you can perceive by consciousness or reflection of internal sense, just as the subject matter of the optics is what you can perceive by sight," says one, or "psychology is the science or phenomena of the mind and is thus marked off from the physical sciences which treat only of the phenomena of matter," says another. But whereas nothing is simpler than to distinguish between seeing and hearing, or between the phenomena of heat and that of gravitation, a very little reflection may convince us that we can not in the same manner distinguish internal from external sense or make clear to ourselves what we mean by the phenomena of the mind as distinct from that of matter.

A phenomenon, as we understand, is what is manifest, sensible, any observable fact or event. For instance, there are ears to hear, eyes to see, and so forth. There is presentation to a subject, and when we get a presentation to a subject we are in the sphere of psychology. In discussing or talking of physical phenomena we, however, almost always abstract from this fact of presentation. Even though consciousness should cease, the physicists would consider the sum total of objects to remain the same. The physicist, whether aware of it or not, has taken up the position which may be described as saying that that which is manifest, evident, sensible, with him means appearance—an object. The physicist would see only the physical side of the tree, while the psychologist would see the physical side as well as the "soul" of the tree. I feel that there is no better way to express the psychologist's point of view than to quote the following from Joyce Kilmer's *Poems and Essays*:

TREES

I think that I shall never see
A poem lovely as a tree.
A tree whose hungry mouth is prest
Against the earth's sweet flowing breast;
A tree that looks at God all day,
And lifts her leafy arms to pray;
A tree that may in summer wear
A nest of robins in her hair;
Upon whose bosom snow has lain;
Who intimately lives with rain.
Poems are made by fools like me,
But only God can make a tree.

The physicist leaves out of sight altogether the facts of feeling and attention, of which natural presentation entails. From the psycho-

logical point of view, on the other hand, the removal of the subject removes not only all such facts as attention and feeling, but all presentation or possibility of presentation whatever. Surely then to call a certain object (when we abstract from the presentation of this object), "a mental phenomenon" is a confusing way of representing the difference between two points of view, for the term "material and mental" seems to apply to the two so-called phenomena having nothing in common, whereas the same object is involved in both; while the term "phenomena" implies that the point of view is in each case the same, when in truth what is emphasized in one the other ignores. We then conclude that psychology can not be defined by reference to a special subject matter as such concrete sciences as minerology and botany can be, and still it deals in some way with the whole experience. To be characterized at all, therefore, apart from metaphysical assumption it must be characterized by the standpoint from which the experience is viewed. Different schools in order to express this have defined psychology as a subjective science and all other positive sciences as objective. This may be misleading. The distinction rather is that the standpoint of psychology is what is often termed "individualistic," that of the objective sciences being "universalistic."

Locke, Berkely, and Hume regarded the critical investigation of knowledge a psychological problem. They set to work to study the individual mind. Their psychology was soon foredoomed to a collapse, but there was a steady advance in psychology as we pass from Locke to Hume. Berkely says "Psychology never transcends the limit of the individual. Before we became conscious there was no world for us; should our consciousness cease, the world for us would cease; had we been born blind, the world for us would have no color; if deaf, it would have no sounds." The Berkeleian standpoint is a standpoint of psychology, but psychology is not pledged to the methods employed by Berkely and Locke. There is nothing to hinder the psychologist from employing materials furnished by his observations of other men, of infants, of animals, or of the insane; nothing to hinder him from taking council with the physiologist or philologist, provided always, he can show the psychological bearings of those facts which are not directly psychological. The standpoint of psychology is individualistic by whatever methods or by whatever sources its facts are ascertained. In order to have a psychological import they must be regarded as having a place in, or as being a part of some one's experience or consciousness. Hence Lange's famous mot; modern psychology is "psychologie ohne Seele." But consciousness, which is the most frequent substitute, is so frequently

confused with self-consciousness. Therefore it seems to me that the logical definition would be "a science of individual experience."

Woodworth says, "None of these formulas is wholly satisfactory. Psychology does not like to call itself the science of the soul, for that has a theological tang and suggests problems that have so far not seemed accessible to scientific investigation. Psychology does not like very well to call itself the science of the mind, as the mind seems to imply some thing or machine, and there is no such thing to be observed (unless it be the brain and body generally), and, anyway, psychology is distinctly a study of actions rather than of things. Psychology does not like to limit itself to the study of consciousness, but finds it necessary to study also unconscious actions. As to "behavior," it would be a very suitable term, if only it had not become so closely identified with the 'behavioristic movement' in psychology, which urges that consciousness should be entirely left out of psychology, or at least disregarded. 'Behavior psychology,' as the term would be understood to-day, means a part of the subject and not the whole. A series of waggish critics has evolved the following: 'First psychology lost its soul, then it lost its mind, then it lost consciousness; it still has behavior, of a kind.'"

In order for the student of psychology to visualize and get an accurate picture of psychology and to form his own satisfactory definition, he should make a thorough study of the work accomplished by the psychologists. If one were to make such a survey, the varieties of theoretical and practical problems under investigation would be revealed to us. We could then determine for ourselves the difficulty in formulating a satisfactory definition.

VARIETIES OF PSYCHOLOGY

Differential psychology.—The beginner in psychology almost always asks these questions: How do people differ? How do different people act under the same circumstances, and why? It is the professional psychologist whom we find making a study of differential psychology. He selects and examines a great number of individuals to see how they differ and upon what their differences depend. By making a careful study of the individual's heredity and environment the psychologist has been able to determine just how much these two factors have influenced the individual. In the Army, during the Great War, the duty of the psychological examiner was to test and measure the intelligence of the army recruits. The Army alpha test was used for this purpose. These experiments were very interesting as well as very valuable, as they proved that men of poor intelligence made poor soldiers, while those of a high degree of intelli-

gence made excellent officers if they possessed good physique as well as courage and leadership.

It is the duty of the psychologist in a place like the children's court to examine delinquent children brought into the court, measure their degree of intelligence, and to try to apprehend the child's peculiar behavior and attitude. The court psychologists and the Army psychologists were engaged in applying a scientific knowledge, after years of study and work, to the practical problems of everyday life.

Applied psychology.—There are many other divisions of psychology and there are many applications of psychology to business, to medicine, to education, to the art of right living, as well as to other occupations. Woodworth says "Scientific knowledge enables you to predict and control. Having devised scientific tests for intelligence, you can predict of a 6-year-old boy who tests low, that he will not get much good from the regular classes in school; and thus you are in a position to control the education of this boy for his own best interests. In the Army, it happened during the earlier part of the war that some companies or regiments made much slower progress in training than others; and a whole division was delayed for months because of the backwardness of a single regiment. When the psychological tests were introduced, these slow-learning units were found to contain a disproportionate number of men of low intelligence. From that time on it was possible by aid of the tests to equalize the intelligence of different units when first formed, and thus insure equal progress in training." This example shows the value of being able to "control."

Nearly all of us in making a study of any subject or science are attracted to its practical side or use, and many show a degree of impatience with any study that does not have an immediate practical side. Fundamentally, any science, no matter how much it is applied to everyday use at the present time, is a "pure science." It must seek most of all to know and understand. Woodworth says that "Practical scientific knowledge was usually first obtained without any inkling of how it might be used. The science of electricity is the most striking example of this. It began as an attempt to understand certain curious phenomena, which seemed to be nothing but curiosities; yet when the knowledge of these phenomena had progressed to a certain point, abundant use was found for it. Much the same is true of psychology, which began as a pure science and only recently has found ways of applying its discoveries to practical affairs. So the student beginning the science, though properly desirous of making practical use of what he learns, should let himself be governed for the present by the desire to know and understand, confident that the more scientific (which is to say, the more complete,

systematic, and reliable) his knowledge is, the more available it will be for practical application." Therefore, we conclude that "applied psychology" is the practical application of the science of psychology.

General psychology.—General psychology is concerned with the main laws and principles that hold in all special fields of psychology.

General psychology has to do with	Differences of people.
	Likenesses of people.
	How do we observe, learn, remember, think?
	Sensations.
	Feelings and emotions.
	Instincts.
General psychology is concerned with	Impulses to action.
	Development of natural powers and impulses.
	1. Normal psychology.
	2. Abnormal psychology.
	3. Child psychology.
	4. Animal psychology.
	5. Genetic psychology.
	6. Social psychology.
	7. Educational psychology.
	8. Clinical psychology.

DEVELOPMENT OF PSYCHOLOGY OR THE FUNCTIONS OF THE FACULTIES OF THE BRAIN

1. Behaviorists: Dynamic psychology deals with the living and the real.

2. Freudism: Freudism is the unconsciousness and influence of sex. Can be explained by conditional responses. Freud's contribution is his theory to explain the fact. Influence of unconscious on behavior.

3. Gestalt: Gestalt psychology (configuration or pattern form). Phi phenomenon. The moving electric sign or the finger in front of the eye which appears to move although stationary when eyes are alternately closed and opened.

Things should be studied as a whole, that is, when we analyze lemonade we get a sweet taste, a sour taste, a sensation of cold, and so forth, none of which constitutes lemonade but all do. Gestalt applies to all sciences and experiences of the whole.

PSYCHOLOGY AND ITS RELATIONS TO OTHER SCIENCES

Psychology and sociology.—Psychology studies the activities of individuals.

Sociology studies the activities of a group of individuals taken as a whole. Woodworth explains this clearly as follows: "Both might be interested in the same social act, such as an election, but sociology

would consider this event as a unit, whereas psychology would break it up into the acts of the several voters. The distinction is clear enough theoretically, but breaks down often in practice, as sociology would like to know the motives that swayed the individual voters, while psychology on its side is interested to know what decision was reached by the majority." Economics and politics, as well as all the other social sciences, have a psychological side, since they are concerned to learn the causes that govern human conduct.

Biology and psychology.—Biology is the study of life or living organisms.

Psychology studies these creatures on the mental side.

Psychology may be called a part of biology or a biological science. It has very close contact with several other branches of biology. Animal psychology overlaps that part of zoology which studies the behavior of animals. The study of mental heredity and development (genetic psychology), dovetails with the general biological science of genetics. We find biologists gathering data on the heredity of feeble-mindedness or of special abilities, while psychologists discuss the general theory of heredity.

Psychology and physiology.—Human and animal physiology have the closest contacts with psychology. Physiology is that part of biology that studies functions or activities, and it includes psychology as a part of itself. It concentrates its effort upon bodily functions such as digestion and circulation. Psychology, in practice, devotes itself to mental functions, such as desire, thought, and memory. Physiology is more apt to delve into the detailed study of the action of the organs of sense, and psychology to concern itself with the classification of sensations and the use made of them. We do not find any clean separation between our science and physiology; but we find, on the whole, that psychology examines what are called mental activities, and that it studies them as the performances of the whole individual rather than as executed by the several organs. It is very difficult to mention any activity that is mental without being physical. Take, for instance, speech:

Physiology studies action of vocal cords and location of brain centers concerned with speech.

Psychology studies child's process of learning to speak and relation of speech to thought. Interested in stuttering, slips of tongue, and other speech disturbances which are said to be mental.

Thinking requires brain action, and the brain is as truly a bodily organ as the stomach. Its activity is a bodily activity and lies within the field of psychology. It is equally difficult to mention any function that is exclusively bodily and not mental at the same time;

in digestion the anticipation of food, when one is hungry, will start the digestive juices to flowing while anger or fear will stop digestion. Therefore, one can readily see how the psychologist becomes interested in digestion and the physiologist becomes interested in the emotions. On the whole, psychology examines the mental activities and studies them as the performance of the whole individual rather than as executed by the several different organs.

Woodworth says the following about the science of consciousness: "The activities that psychology studies are conscious performances, while many of those falling to physiology are unconscious. Thus digestion is mostly unconscious, the heart beat is unconscious except when disturbed, the action of the liver is entirely unconscious. Why not say, then, that psychology is the study of conscious activities? There might be some objection to this definition from the side of physiology, which studies certain conscious activities itself—speech, for example, and especially sensation. There would be objection also from the side of psychology, which does not wish to limit itself to conscious action. Take the case of any act that can at first be done only with close attention but that becomes easy and automatic after practice; at first it is conscious, later unconscious, but psychology would certainly need to follow it from the initial to the final stage, in order to make a complete study of the practice effect." An excellent example of this is a child learning to walk. And then there is the unconscious or the subconscious mind, a matter on which psychologists do not wholly agree among themselves; but all would agree that the problem of the unconscious was appropriate to psychology.

For all the objections it remains true that the typical mental process, the typical matter for psychological study, is conscious. Unconscious mental processes are distinguished from the unconscious activity of such organs as the liver, by being somehow like the conscious mental processes. It would be correct, then, to limit psychology to the study of conscious activities and of activities akin to these.

The animal psychologists object very much to defining psychology as a science of consciousness, and limiting it to consciousness. Many experiments have been made on dogs, rats, and other animals and in observing the behavior (motor and glandular) of these animals much has been learned in regard to instinct and learning in animals. The animal psychologists insist that human psychology no less than animal psychology is properly a study of behavior. Naturally we assume that the animal is conscious, but it is impossible to directly observe its consciousness and it is further impossible for one to know the state of mind or sensation of the animal. In order to learn this, the animal would have to make a report. No one can observe another's consciousness.

METHODS OF OBSERVATION

Psychology can hardly be defined without considering its methods of observation. Psychology has two methods, the objective facts and the subjective facts. The objective facts are movements of a person's body, movements of any part of his body, secretions of his glands (flow of saliva), and external results produced by these bodily actions, results such as objects moved, path and distance traversed, marks made on paper, columns of figures added, sounds produced, etc. These objective facts can be observed by another person.

The subjective facts can be observed only by the person performing the act. The subjective facts are observation of sensations in joints and muscles produced by leg movement, frame of mind, as pleased or displeased, and thoughts. ("There's no art to read the mind's construction in the face." One may feign sleep while attending to what is going on round about him.) In order to get the subjective facts, it is necessary to enlist the person himself as the observer.

EXPERIMENT

Isolation of facts to be studied.

Repetition under controlled conditions.

Controlled variations with conditioned responses.

Result and process of experimenter.

Subject :	Process :	Results :
Experimenter.	Introspection.	Impression.
	Expression.	Observation.

The experimenter can report on facts unknown to the subject, as reflexes, sugar in blood, psychological reactions, etc. For example: By using the esthesiometer and making two contacts with a dissecting knife, two impressions are reported; if the two points are moved nearer together, an impression of two short lines results; if further brought together, a condition of one line results, and finally a single point of contact is experienced. Success of measurement depends upon the variables—time, quantity, quality, and difficulty. Use three constants to determine the difference of one variable as use of time, quality, and difficulty to determine quantity, etc.

COMPARATIVE PSYCHOLOGY

In comparative psychology the actions of individuals, classes, or species, noting likenesses and differences, are compared. Norms and averages are established and one notices how closely people cluster about the norm and how far individuals differ from it. In order to tabulate measures into a frequency distribution, it is necessary to introduce tests of various sorts, by which one can get a precise

measurement of the individual's performance. By use of the double comparison or "correlation" one is able to work out the relationship of various mental and physical traits.

Method of correlation.—Relation of some capacity, as general intelligence, to some other capacity, as musical ability. For example, we ask whether there is any relation between general intelligence as measured by standard intelligence tests and scholastic achievement as measured by marks or grades. Or we may inquire whether an individual who gives evidence of high general intelligence tends to outstrip the average individual in school work. Are certain abilities highly related and others relatively independent? In the correlation method we are forced to recognize other factors and their importance. Tests and correlations have become essential in psychological investigation and rank on a par with the experimental method. A test is an experiment or based on an experiment. "An experiment typically takes a few subjects into the laboratory and observes how their mental performances change with planfully changed conditions; whereas a test goes out and examines a large number of persons under one fixed set of conditions." The results may be beneficial in many ways, either for practical purposes as guiding one in the choice of an occupation or for scientific purposes.

In the genetic method, the object is to trace the mental development of a race or individual. It may be the tracing of the development of mentality in general or of some particular mental performance. It is of value in the study of mental development. The pathological method runs hand in hand with the genetic method and is the study of the decline of mental power, due to senility, brain disease, and maladaptations that appear in insanity and other disturbances. Here psychology has close contact with psychiatry, which has contributed a great deal of psychological information to pathological psychology.

Woodworth sums up his attempt at a definition in this manner:

Having now made a rapid preliminary survey of the field of psychology and of the aims and methods of the workers in this field, we ought to be in a position to give some sort of a definition.

We conclude, then, psychology is a part of the scientific study of life, being the science of mental life. Life consisting in process or action, psychology is the scientific study of mental processes or activities. A mental activity is typically, though not universally, conscious; and we can roughly designate as mental those activities of a living creature that are either conscious themselves or closely akin to those that are conscious. Further, any mental activity can also be regarded as a physiological activity, in which case it is analyzed into the action of bodily organs, whereas as "mental" it simply comes from the organism or individual as a whole. Psychology, in a word, is the science of the conscious and near-conscious activities of living individuals.

Psychology is not interested either in dead bodies or in disembodied spirits but in living and acting individuals.

One more word on the psychological point of view. In everyday life we study our acquaintances and their actions from a personal standpoint; that is, we evaluate their behavior according as it affects ourselves, or, perhaps, according as it squares or not with our standards of right and wrong. We always find something to praise or blame. Now, the psychologist has no concern with praise and blame, but is a seeker after the facts. He would know and understand human actions rather than pass judgment on them. When, for example, he is introduced into the school or children's court for the purpose of examining children that are "problems," his attitude differs considerably from that of the teacher or officer of the law; for while they almost inevitably pass judgment on the child in the way of praise or blame the psychologist simply tries to understand the child. The young delinquent brought into the laboratory of the court psychologist quickly senses the unwonted atmosphere, where he is neither scolded nor exhorted, but asked to lend his cooperation in an effort to discover the cause for his conduct being as it is. Now, the psychological attitude is not necessarily "better" than the other, but it is distinctly valuable in its place, as seen from the fact that the young delinquent often does cooperate. He feels that if the psychologist can find out what is the trouble with him this may help. Nothing indeed is more probable; it is when we have the facts and trace out cause and effect that we are in a fair way to do good. Nothing is more humane than psychology, in the long run, even though the psychologist may seem unfeeling in the course of his investigation.

To the psychologist, conduct is a matter of cause and effect of natural law. His business is to know the laws of that part of nature which we call human nature, and to use these laws, as fast as discovered, for solving the problems presented by the human individual or group. For him, even the most capricious conduct has its causes, even the most inexplicable has its explanation if only the cause can be unearthed, which he does not pretend he can always actually accomplish, since causes in the mental realm are often very complex. No one can be a psychologist all of the time; no one can or should always maintain this matter-of-fact attitude toward self and neighbor. But some experience with the psychological attitude is of practical value to anyone in giving clearer insight, more toleration, better control, and even saner standards of living.

REFERENCES

- Psychology. A Study of Mental Life. Woodworth.
Statistics in Psychology and Education. Garrett.
Biometry. Roseman.

NOTES AND COMMENTS

LETTERS OF COMMENDATION

In accordance with the statement made in the preface of the *BULLETIN*, the Surgeon General of the Navy appointed a board to select the papers published in the *BULLETIN* during the year 1928 which it considered to be worthy of letters of commendation. As a result of the selections made by the board, letters of commendation have been sent to the officers named below for the papers which appear opposite their names.

Lieut. Commander J. C. Adams, Medical Corps, United States Navy, The Physical Examination for Flying, with Special Reference to the Eyes.

Commander E. W. Brown, Medical Corps, United States Navy, Chemical Warfare and the Naval Medical Officer.

Commander G. F. Cottle, Medical Corps, United States Navy, Fractures.

Capt. E. F. Du Bois, Medical Corps, United States Naval Reserve, Physiology of Respiration in Relationship to the Problems of Naval Medicine, Parts I, II, III, and IV.

Lieut. Commander E. C. Ebert, Medical Corps, United States Navy, Treatment of Gonorrheal Ophthalmia.

Lieut. Commander E. G. Hakansson, Medical Corps, United States Navy, Experiences with the Blood Sedimentation Test.

Lieut. T. H. Hayes, Medical Corps, United States Navy, Hookworm as a New Health Problem in St. Croix.

Commander L. W. Johnson, Medical Corps, United States Navy, Cases Illustrating Maxillo-Facial and Plastic Surgery.

Lieut. G. H. Larson, Medical Corps, United States Navy, Dermatitis Exfoliativa Due to the Arsphenamines.

Lieut. Commander G. H. Mankin, Medical Corps, United States Navy, Medical Aspects of the Salvage of the United States Submarine *S-4*.

Lieut. Commander R. P. Parsons, Medical Corps, United States Navy, Spinal Fluid in Tropical Syphilis.

Lieut. W. M. Simpson, Medical Corps, United States Naval Reserve, Tularemia (Francis's Disease).

Lieut. Commander E. E. Smith, Medical Corps, United States Navy, Heat Stroke a Thermoregulatory Incompetency.

Lieut. O. B. Spalding, Medical Corps, United States Navy, The Pineal Shadow—A Diagnostic Landmark.

Rear Admiral E. R. Stitt, Medical Corps, United States Navy, Our Disease Inheritance from Slavery.

Commander M. A. Stuart, Medical Corps, United States Navy, General Considerations on Amœbic Dysentery and Endamœbic Carriers from the Viewpoint of a Naval Surgeon.

Lieut. Commander P. W. Wilson, Medical Corps, United States Navy, Notes on a Malaria Survey at Port de Paix, Haiti.

CORRECTIONS

In the paper on Succinylchlorimide as a Chemical Agent for the Preparation of Potable Water, by Maj. Cyrus B. Wood, Medical Corps, United States Army, which was published in the January, 1929, number of the BULLETIN, an error occurred on page 225 in the titles following the names of Col. C. R. Darnall and Col. W. J. Lyster. Each of these names should have been followed by the words: "Medical Corps."

PRINCIPLES GOVERNING DISTRIBUTION OF PERSONNEL OF MEDICAL AND HOSPITAL CORPS

In order that the service at large may understand why the bureau often declares itself unable to take favorable action on requests for increase of personnel, there is presented a brief reference to the limitations under which the bureau operates, together with an explanation of the general principles governing distribution of personnel.

The total number of personnel being limited, and all being employed, it is obvious that increasing the number at any station or creating a new billet, involves reducing the number elsewhere. Hence, the needs of a station can not be considered without reference to needs elsewhere, and the task of the bureau is essentially one of effecting equitable distribution.

"Military" activities, having priority over all others, are filled first. Because most activities other than the hospitals are regarded as more immediately "military," and because with them each medical officer represents a large percentage of the total staff, these are rarely reduced below their current quotas, the hospitals thus being forced by military exigency to serve as reservoirs on which to draw when vacancies develop elsewhere or when new billets are to be filled.

While hospital staffs, owing to their numerical size and the admirable spirit with which personnel respond to increased demands, are somewhat elastic, there is limit to the extent to which their staffs can be reduced; and the bureau feels that that limit has been closely approached, if not reached. Hence, it is obliged to question all requests for personnel which if granted would result in further reducing hospital staffs.

After the more strictly military requirements have been met, the medical officers remaining are considered available for detail to hospitals, and are allocated, broadly, in proportion to annual admissions.

Before any workable "system" of allocation could be put into effect, it was necessary to give some attention to the soundness of the several elements of procedure involved. Therefore, preliminary study was undertaken for the purpose of ascertaining: (a) A correct index of the volume of work at a hospital; (b) a correct ratio of personnel to a unit volume of work; and (c) a reasonably reliable guide for estimating at any time the average volume of work for the ensuing year.

While the several indices finally adopted may fall short of accuracy—and certainly none are perfect—they have been evolved from an extended and careful study of actual requirements as developed over a period of several years; more important, in daily use their practical value has been proved.

a. VOLUME OF WORK.—The number of annual admissions is believed to represent more correctly than any other available information the total volume of work performed in a hospital. Although the figures obviously fail to take reckoning of consultations and examinations of families or other casuals, it is believed that the total amount of such work in each institution is approximately proportional to the volume of hospital work proper, and therefore, if computed, would have no appreciable effect on the relative value of the admission index, it being remembered that inasmuch as the total number of personnel is limited, the index necessarily represents a proportional number to be allocated and not necessarily an absolute number. It is likewise believed that while at a given hospital peculiar conditions may obtain as to personnel requirements, it is true of all hospitals. They all have special conditions, and it may be fairly assumed that these conditions in effect cancel each other.

b. RATIO OF PERSONNEL.—The number of medical officers nominally required is established on the basic ratio of 1 to each 200 annual admissions, modified by a graduated sliding scale designed to com-

pensate for the greater economy in employment of personnel possible in larger institutions.

It has been found also that a medical officer, in handling the four admissions a week as fixed by the ratio described, may be expected to take care of a correlated number of 20 resident patients. It may so happen, however, that in certain hospitals in which the cases are generally of such nature as to require long hospitalization, the number of patients in hospital may exceed that number that can be taken care of by the number of medical officers allotted on the basis of annual admissions. In such case, additional officers are allowed in proportion of 1 for each 100 patients of such excess.

While nominal complements are determined by the procedure described, the actual number of officers "on board" usually falls below "complement"; for, the strength of the corps being insufficient to meet full requirements, the best that can be done is to effect equal approximation to the standard in all cases.

That being accomplished, and there being no reserve on which the bureau can draw, each activity must take care of leave, sickness, etc., occurring among its personnel, and also must meet with its own resources any temporary increase in volume of work.

In brief, personnel are allocated in proportion to the volume of work performed, the same scale being applied to all activities; and it becomes the task of the commanding officer to organize his staff in the most effective manner possible with the personnel available.

c. FORECASTING VOLUME OF WORK.—Inasmuch as transfer of medical officers can be made only on stated occasions, if that approximation to standards which may be current is to be maintained in all hospitals alike, details must be made primarily with a view to future needs. Therefore, it is essential that the bureau have information which will serve to indicate what those future needs may be. It is evident that the experience of previous years furnishes the only reliable basis for such estimates.

The experience of more than one year is taken, in order to obviate the effect of localized ephemeral epidemics which may never recur; and of less than three years in order that due weight may be given to a progressive increase in the number of admissions that has been continuous and likely to continue. As a compromise, the experience of the preceding two years has been adopted.

It often happens, however, that on a certain date the number of beds in a given hospital allocated to Veterans' Bureau patients is increased, and that the pressure of Veterans' Bureau requirements thenceforth keeps those beds occupied. In such case, it being known that permanent personnel requirements have been correspondingly increased, appropriate adjustment is effected as soon as possible.

The chief defect in this system of allocation, as a whole, is the lag in effecting complete adjustment evident when in any year the number of admissions differs materially from the average of the two previous years. A hospital with a higher rate suffers accordingly.

This lag constitutes a defect not easily obviated, since it is inseparable from the practice of using past experience to forecast future needs; and it is fortunate that the lag, while it occasionally operates to the advantage or disadvantage of some hospital, rarely does so to any material extent. To officers in the field, indeed, the principal defect in the system seems to be that when admission rates are rising sharply, no additional personnel are forthcoming in response to urgent requests.

There are reasons for an attitude which must seem at times to represent indifference to existing needs. Usually, when an acute rise takes place in one hospital, other hospitals are experiencing, or will soon experience, a similar rise, and the need for additional personnel will be as great in one place as in another. Even if the rise is at the moment limited to one institution, there is no assurance that such increase will be maintained; and shifts in personnel which are necessarily permanent can not be made to meet an increase in patients which may be brief. A single example will suffice to illustrate the usual result of responding to calls of this nature: A certain hospital, expecting a heavy influx of patients, succeeded in inducing the bureau to increase its personnel in anticipation. There did take place a rise, but it was inconsiderable and brief. The excess personnel could not be moved again, and the final result was that the hospital in question had throughout much of the year relatively five times as many medical officers and hospital corps men as its nearest neighbors.

The one wholly flexible method of allocation—to consider all personnel perfectly mobile, and to shift them from one station to another in accordance with fluctuations in patients—is impracticable because of attendant transportation costs, loss of individual efficiency involved in frequent change of billet and loss of institutional efficiency in high turnover, and the hardship imposed on medical officers in forcing them to incur the expenses of moving, interruption of school, carrying unexpired leases, and assuming the high cost of living incidental to brief residence.

The foregoing describes the application of the system to hospitals. The same general method, however, is applied to most other activities such as navy yards, Marine Corps bases, training stations, and air stations. Indeed, it is for the purpose of computing current requirements and thus maintaining correct adjustment that the bureau desires the itemized data which it has requested be incorporated in Form NMSHC-4.

In computing the requirements of the activities enumerated in the preceding paragraph, weight is given not only to numbers but also such elements as the difference in the respective demands of civil employees and aviation pilots, the availability of an officer specially detailed for family work, and whether the situation of the unit requires that it conduct its own hospitalization.

For the sake of clarity, in the foregoing description, medical officers alone have been specifically mentioned. The same method of allocation, however, is observed in the detail of other personnel. For this purpose, the ratio of hospital corps men to medical officers which should obtain in each type of activity has been ascertained, and the standard complement so determined is, as is the case with medical officers, approximated as nearly as the total number of available corps men permits.

DANGER OF EPHEDRINE IN HEART FAILURE

Although ephedrine has been employed in Chinese medicine for more than 5,000 years, it has only come into wide use in the United States since 1923. It has been extensively advertised and sold to laymen for the relief of asthma and hay fever without any restrictions surrounding its sale.

Recent literature has called attention to certain untoward effects from the use of this drug, and one article of particular interest and value in showing the danger of ephedrine in cases of heart failure appears in the September, 1928, number of the Archives of Internal Medicine. W. A. Bloedorn, commander, and P. F. Dickens, lieutenant, Medical Corps, United States Navy, who are the authors of that article, have cited a very instructive case which they studied at the Naval Medical School.

This patient had taken 40 capsules of three-eighths grain of ephedrine over a period of 20 days and had developed evidence of acute cardiac decompensation accompanied by marked dyspnea, sweating, tremors, weakness, and palpitation. These symptoms were always aggravated after each dose of the drug. By discontinuance of the drug and with rest and digitalis he returned to a comparatively normal state in a few weeks' time.

The authors, after an interesting discussion of the pharmacology and uses of this drug, including certain definite advantages it has over epinephrine, have concluded from their studies and from their observations on the case cited that:

1. Ephedrine is a dangerous drug to use when patients show evidence of cardiac damage.

2. Extreme care is necessary in the diagnosis of bronchial asthma, as not infrequently cases of so-called "cardiac asthma" are put in this group.

3. Ephedrine may produce acute cardiac decompensation and pulsus alternans in patients with damaged hearts.

4. If during administration of ephedrine the patient exhibits any toxic symptoms such as palpitation, tachycardia, arrhythmia, or vasomotor disturbances, the drug should be promptly discontinued.

DIFFERENTIAL DIAGNOSIS OF SURGICAL FROM NONSURGICAL JAUNDICE BY LABORATORY METHODS

Recent literature has indicated an increasing realization of the clinical value of the knowledge that can be derived from the van den Bergh and other biliary tests.

Lucius W. Johnson, Commander, Medical Corps, United States Navy, and Paul F. Dickens, Lieutenant, Medical Corps, United States Navy, have contributed an article of unusual interest on this subject in the American Journal of Medical Sciences of November, 1928.

They have reported five cases with a detailed correlative study of the clinical and laboratory findings, and have summarized their conclusions so well that these are here quoted in full:

1. Persistent jaundice is accompanied by definite injury to the liver, kidneys, and other structures.

2. Early determination of the cases which require surgery will lead to earlier operation, resulting in lower death rate and less morbidity from permanent tissue damage.

3. The laboratory test will aid the surgeon to decide for or against operation at an earlier stage.

4. Laboratory indications for surgical intervention are: (a) Persistent and increasing jaundice, with a direct immediate van den Bergh reaction; (b) dye retention; (c) absence of bile or dye from duodenal contents.

5. The recovery of bromsulphalein by duodenal siphonage is a point against complete obstruction.

6. High bromsulphalein retention is indicative of obstruction of the common duct or of loss of function of a large part of liver substance. Toxic and infective jaundice gives relatively high dye retention, but the figures are 15 to 20 per cent lower than those obtained in obstruction to the common duct. Malignant disease of the liver gives relatively low dye retention and dye may be obtained by siphonage from the duodenum.

We believe that the laboratory will give material aid in differentiating operable conditions from malignant disease of the liver and that it will help the surgeon in postoperative treatment. It is recommended that, in all operative procedures on the liver, the pre-operative and postoperative treatment include the administration of glucose and sodium chlorid. It has been shown that cholemia and tetany may be controlled by the adequate administration of these substances.

George M. Piersol and Maurice M. Rothman have contributed an article of unusual merit on this subject in the December 8, 1928, number of the *Journal of the American Medical Association*. Their study is based on observations extending over a period of four years on some 300 patients at the University of Pennsylvania Hospital. As a result of this study, they believe the following conclusions justified:

1. Of all the liver function tests thus far devised, those of greatest clinical value and general usefulness are (1) the estimation of urobilinogen; (2) the determination of serum bilirubin (either by the quantitative van den Bergh test or, better, by the icterus index); and (3) the estimation of the degree of retention of the dye bromsulphalein.

2. Urobilinogen is probably the most delicate single test for liver dysfunction. It is always increased, even when the injury to the parenchyma is slight or when excessive blood destruction brings about an increase in bile pigment formation. In our experience, urobilinogen is constantly increased to a noteworthy degree in portal cirrhosis.

3. The presence of latent icterus, as revealed by serum bilirubin estimations, is of distinct importance both diagnostically and prognostically, because in this way even slight degrees of bile retention may be determined.

4. The retention of bromsulphalein is valuable confirmatory evidence of liver dysfunction. Such retention rarely occurs unless one or both of the liver function tests already mentioned are positive, with the exception of portal cirrhosis, in which dye retention occurred in the absence of hyperbilirubinemia.

AGRANULOCYTIC ANGINA

Since Schultz's report in 1922 of the condition known thereafter as agranulocytic angina, this disease has been more frequently recognized, both in Germany and the United States. Kastlin in 1927 reviewed 43 cases in an article in the *American Journal of Medical Sciences*. More than 50 cases have been reported to date. Sharp and Setterstrom reported in the *BULLETIN* of January, 1929, a fatal case from the naval hospital at Pearl Harbor. In that case a streptococcus was isolated from the blood culture obtained at autopsy. Blood cultures in most of the cases have been negative.

Another recent case report is that by William Allan in the *Annals of Internal Medicine* of December, 1928. This case occurred at Charlotte, N. C., in May, 1928. In this case, in addition to the usual objective signs and blood findings, there was a much more severe thrombopenic purpura than has previously been reported.

The syndrome, as summed up by Allan, consists of sore throat, high fever, prostration, and headache, with ulcer formation about the oral cavity, from which there is bleeding. Jaundice occurs in about one-half the cases. More than 90 per cent of the cases die within the first two weeks. There is a leukopenia with a relative increase in the lymphocytes.

HEALTH OF THE BRITISH NAVY

Surg. Commander D. H. C. Given, Royal Navy, writing in the *Journal of the Royal Naval Medical Service* of October, 1928, compares present-day health conditions in the British Navy with conditions in the days of sailing ships and with the health of the native civilian labor force at the naval base at Singapore.

From these lengthy comparative studies, Doctor Given concludes that living conditions in this great industrial age have resulted in a certain physical depreciation, and that because of these living conditions the health of the British sailor has in certain important particulars "fallen far below that of the native laborer." He believes there is an increasing tendency to adiposity and regrets the absence of tests or measurements whereby "real physical well-being can be distinguished from its overfed imitation."

He finds significant the high dental standard of eastern races, associated with a high standard of abdominal health. In the absence of endemic or specific disease they appear to enjoy the health of lower animals. He cites in this connection the case of 100 native women and children who were under observation for 18 months and who enjoyed a complete absence of sickness during that period. Such a condition would certainly be regarded as exceptional in England.

"The march of civilization," he says, "is responsible for constant changes to which the changing disease picture in civilization is attributable." For example, tuberculosis so common a century ago was associated with the birth of industry and the attendant sudden change from rural conditions to overcrowding in cities and insanitary conditions of factories. Tuberculosis is now on the decline with better working hours, wages, and nutrition, and the diseases in the ascendant are those that appear to have followed in the wake of industrial prosperity—diabetes, cancer, and surgical diseases of the digestive tract, including dental diseases.

Important changes in the last half century have been in the dietary of the people and in the reduction of manual labor. The consumption of refined sugar and of roller-milled and devitalized flour has greatly increased. These dietary and labor changes apply as much to the Navy as to civilian communities.

Doctor Given finds justification for the belief that we have a new pathological entity in "saccharism" which he defines as "the sequelæ of overnutrition combined with deranged metabolism resulting from insufficient physical exercise."

The overnourished body is compared to "the banked fire with dampers closed down," and lack of exercise means "deficient aera-

tion, incomplete combustion, and the accumulation of the unburnt products of metabolism." This "metabolic stasis" might explain "the origin of lowered resistance to infection, which is so characteristic a feature of civilized pathology to-day. As a cause of depressed cell vitality it might also prove to be the predisposing cause of irregular cell growth and malignant neoplasm." The beneficial eliminatory function of the skin is also lost by lack of exercise. "The native laborer who leads the simple life and lives 'by the sweat of his brow' attains very near the 'fighting fit' standard of health."

There are many tables of apparent significance in this article, comparing the incidence of certain diseases in England to-day with their incidence in former years, and with their incidence among races whose living conditions have changed very little in the last 50 years. For example, appendicitis is twelve times more common in British troops serving in India than it is in native troops; and cancer of the stomach is twelve times more common in London than it is in Calcutta.

INJECTION TREATMENT OF VARICOSE VEINS

G. H. Colt, writing in the British Medical Journal of September 22, 1928, believes that the injection method of treating varicose veins is "yielding * * * with negligible risk and little inconvenience, results which are so much better than were possible by laborious and somewhat risky operations, that operation seems to be no longer justifiable except in certain very isolated cases."

Although injections were made as early as 1854, the drugs and technique used at that time and for many years later resulted so often in septic phlebitis, sloughing, septicemia, and embolism that the method fell into disrepute. In 1918, Sicard in Marseilles, injected varices with neutral sodium carbonate in doses of from 5 cubic centimeters of 5 per cent solution to 15 cubic centimeters of 15 per cent solution, and later adopted a solution of sodium salicylate in strengths of 20 to 40 per cent. Many other solutions have been tried by various people, but several of these solutions have been found to be too toxic.

After injection the veins contract and the walls may stick together. The endothelium becomes tumefied and there may or may not be infiltration. In a week the clot is undergoing organization and the lumen of the vein is greatly narrowed.

Doctor Colt states that he now commonly "obtains an almost complete obliteration of a valveless internal saphena system after one injection." His procedure is as follows:

The patient stands on a chair near a table and a single band tourniquet is tightly applied around the upper part of the thigh to help to prevent the veins from emptying too rapidly during recumbency. The patient then lies down on

the table and the vein is entered, preferably above the knee or in the main trunk of it below the knee; the tourniquet is loosened, the vein is emptied of blood near the needle, and a finger is placed on it above the middle of the thigh; 2 to 6 cubic centimeters, according to the size of the veins, of 30 per cent sodium salicylate, with 10 per cent sodium chloride solution (P. D. & Co.) are injected, preferably toward the groin; the limb is elevated to 30° for three seconds, and then the patient rises slowly and stands on the chair. The finger is removed and the charge of solution sweeps downward into the saphena system. This is painful for half a minute. The patient describes the pain as continuous and stinging or as cutting, lancinating, or cramplike, and feels it traveling down the leg to the foot. These omens are favorable. By letting the patient lie down at this stage and again elevating the limb for a few seconds the solution may perhaps be tipped back again or kept a little longer in the saphena. Active muscular movement at once sucks the solution away and dilutes it rapidly. No bad effect has been noticed. Sometimes the solution must miss outlying varicose groups because these may require separate injections a week or a fortnight later, when the effect of the first injection has become manifest. At this time also the external saphena system, or the large anastomotic vein from the external to the internal system, which is often present in front, below, or above or behind the knee, may be injected. A week after the first injection the internal saphena system is generally hardening from the middle of the thigh to the lower third of the leg. Exceptions seem to be explicable by the well-known common sites of the chief deep anastomosing channels which dilute the solution.

Hilbert F. Day and Walter S. Levinson, writing in the November 8, 1928, number of the New England Journal of Medicine, report their experiences with sodium and quinine salts which they have been using at the Boston Dispensary. They list as requirements for a chemical substance: (1) It should strongly irritate the intima, but not cause sloughing if deposited in the perivenous tissues; (2) it should have no general effect; (3) toleration of the vein to the substance should be low or nil (so that in repeated injections larger doses are not necessary).

There have been no deaths in the series of these writers and they call attention to the fact that the mortality from this method at other institutions is much lower than for operated cases.

They have been able to start treatment in cases with large ulcers, aiming to obliterate veins beneath the ulcers, and have met with encouraging results in this respect.

INTERNAL FIXATION OF FRACTURES AND DISLOCATIONS WITH HUMAN FASCIAL SUTURE

Various materials and methods have been used for the open reduction of certain bone and joint injuries, and while some of these methods are adaptable to individual cases, their disadvantages are many; and, in general, the need of more satisfactory materials and methods has been felt.

Russell H. Patterson reports excellent results in cases treated at the Bellevue Hospital by using the human fascial suture. He describes this method and reports the results in the *Annals of Surgery* of November, 1928.

The method was used in 14 cases, in each of which at least 1 other method had previously been tried and found unsatisfactory. Excellent results were obtained in all cases. Five of the cases are reported in detail. One case suggested that the fascial suture might be of great use in holding a bone graft in place.

The technique is best described by the drawings in the article. A long strand of fascia lata about three-eighths inch wide is used, being removed from the thigh as in the preparation of a fascial suture for hernia repair by the Gallie method. The fascia is passed through drill holes in the fragments, circled about the bone, and tied with a square knot. Chromic catgut sutures are used to secure the fascial knots.

PREVENTION OF RECURRENT RENAL CALCULI

Very little has been written or said on the subject of prevention of recurrent renal calculi. Results have been disappointing and consequently the subject is unpopular in regard to publication.

Ernest O. Nay has brought together some ideas which seem to be valuable, in a paper read by him before the Chicago Urological Society and which appears in the *Journal of Urology* of November, 1928.

Doctor Nay believes that one reason for an apparent high rate of recurrence is that frequently (in about one-third of the cases) some stones or débris are left at the time of operation.

The reason stones are left are:

1. The renal pelvis is a complex cavity having ramifications (calices), some with large and some with small orifices and sometimes bifid, making difficult exploration.
2. X-ray shadow may show a large stone which may be hiding the smaller one. At operation the larger one is removed and no further examination made and, of course, the smaller one is left.
3. Small stones are often hidden by blood clots and overlooked.
4. In dealing with a horseshoe kidney and kidneys tied down by dense adhesions it is not possible to raise them, and often a small piece is left in.
5. In the operation of crushing a stone in the pelvis small pieces are lost sight of.

According to the work of Rosenow and Meisser in 1922-23 infection plays an important rôle in the etiology of stone formation, and this theory is perhaps now more widely accepted than any other.

In addition to removing the stones at operation one must direct every effort toward the removal of all infectious foci and against

stagnation in the kidney pelves, since, as Chute has suggested, infection furnishes the protein substance upon which the deposit of mineral begins, and stagnation favors precipitation.

Nay often performs pelvic lavage at weekly intervals for several weeks before operating, as this establishes drainage, improves renal function, decreases the infection, improves the patient's general condition and thus lessens the possibility of recurrence. Also, he re-X rays for stone before closing the wound to make sure that all pieces of stone have been removed. Three weeks after the removal of the stone he again performs pelvic lavage, using 0.5 per cent mercuriochrome solution, and repeats this weekly from four to six times. The patients are asked to return every three months over a period of three years for reexamination in regard to stone recurrence and recurrence of urinary infections.

Although the series reported on is rather small and the time interval insufficient to warrant very positive statements, the results have been most gratifying in the cases where the routine described has been followed.

ADVANTAGES AND DANGERS OF INLYING URETERAL CATHETER IN KIDNEY INFECTIONS

Drainage of the infected kidney with an inlying catheter has become a popular procedure and has proven its worth in many hands. Catheters from size 4 to 10 French have been left in the ureter for periods of from a few hours to 10 days.

While very few references to dangers or accidents have been made, experience has led Dr. E. Clay Shaw to believe that the procedure is not without danger and that serious injuries might result when it is not intelligently used.

He records his clinical observations and describes a series of animal experiments in the Southern Medical Journal of November, 1928. From these observations and animal experiments he concludes that:

Drainage of the infected kidney with the inlying catheter in appropriate cases is a valuable procedure. In obstinate cases of acute pyelonephritis, the temperature can often be brought to normal and toxic symptoms relieved within 24 hours by the insertion of an inlying catheter. There are cases of pyelitis of pregnancy in which other therapeutic measures will fail and only the use of the inlying catheter can obviate the necessity of therapeutic abortion. Pyonephrotic kidneys can at times be saved by a period of inlying catheter drainage, while in other instances, where the patient has become debilitated from long-continued absorption of toxic products from an incompletely drained pyonephrosis, the condition may be so improved that nephrectomy can later be performed with greater safety.

While we recognize the value of the inlying catheter, clinical observations and animal experimentation have led us to believe that permanent injury may be done the ureter by the injudicious use of it. The ureter is a delicate struc-

ture with an intricate physiology and will not withstand for an indefinite period the presence of a catheter sufficiently large to keep it in a state of continuous tension. The danger would appear to be even greater should the catheter be placed in the acutely inflamed ureter. We believe that indwelling catheters larger than No. 6 French should rarely be used in acute pyelonephritis and that they should not be allowed to remain in place continuously longer than 24 hours. In long-standing pyonephrosis the pus is usually thicker, and catheters smaller than No. 8 French may become obstructed; but it seems advisable, even in these cases, to employ as small catheters as possible. Should a catheter larger than No. 8 French be absolutely necessary for drainage, it is probably best that it should not be allowed to remain in the ureter continuously longer than 12 hours.

CYSTITIS

It is worthy of note, though not at all surprising, that in the same month two different men have written articles with an identical title, "Cystitis," the two publications showing that these two men have almost identical conceptions of this condition.

One of the articles, by C. C. Woods, appears in the Kentucky Medical Journal of October, 1928; the other, by Samuel E. Kramer, is in the Journal of the Medical Society of New Jersey of October, 1928.

Modern urology has so clarified our knowledge of this disease that it is not difficult to understand the very wide and exact agreement on all but the very minor and unimportant points concerned.

Bladder infections are rarely primary, and as Woods says, "the bladder is usually the victim and not the offender, and if we relieve the evil influences (elsewhere), the bladder will most often return to normal."

Cystitis may be secondary to a great variety of conditions, among which should be mentioned renal infections (nontubercular), renal tuberculosis, gonorrhea (which involves only the trigone by contiguity from the posterior urethra), focal infections in teeth, tonsils, appendix, and gall bladder; seminal vesicles and prostate in the male and cervix and tubes in the female; conditions causing urinary stasis or retention, as stone, stricture (either urethral or ureteral), enlarged prostate, pregnancy, postoperative and cord lesion paralyses.

The colon bacillus is considered the most frequent agent responsible, with the streptococcus, staphylococcus, gonococcus, and tubercle bacillus in the order of frequency named.

As for the value of such new drugs as hexylresorcinol and pyridium in the treatment of cystitis, Helmholtz has summed up the situation very nicely in his statement that "the value of different modes of treatment in cases of acute cystitis has always been very difficult to determine: First, because of the difficulty in knowing whether the infection is of the kidney, the pelvis, or the bladder; second, because

pyelitis is a self-limited disease of a great range of severity; and third, because anatomic anomalies seriously interfere with the cure of infection. It would, therefore, be almost impossible to judge the relative merits of different drugs by treating a series of cases with each drug. Even the more chronic infections may clear up spontaneously, regardless of treatment."

RECENT ADVANCES IN THE CHEMOTHERAPY OF SYPHILIS

In his Cameron lecture at the University of Edinburgh, Dr. C. Levaditi has given an excellent résumé of the present status of chemotherapy in syphilis. The lecture is abstracted in the *British Medical Journal* of September 22, 1928.

Levaditi and Sazerac demonstrated in 1922 the spirocheticidal properties of bismuth, and in the same year these authors with Fournier and Guenot used bismuth salts in the cure of human syphilis.

They noted that bismuth was more toxic intravenously than intramuscularly, and noted the clinical and serological improvement following its use, and the durability of effects produced. Levaditi suggests that this durability may be due to the tendency of bismuth to form deposits in the body.

Levaditi and Yamanouchi (1908) showed that atoxyl had no action on trypanosomes *in vitro*, but that it was activated by the organism, and a substance—trypanotoxyl—was formed which was an active spirocheticidal agent. In the same way bismuth is activated by the body tissues (in particular by the liver), with the formation of a protein compound of bismuth-bismoxy.

Recent experiments with camphocarbonate of bismuth, which is an oil soluble compound, have shown this to be very efficacious.

Levaditi and his coworkers have tested *in vivo* the spirocheticidal action of 40 metals. Of these, 8 were found to be active—namely, arsenic, gold, mercury, bismuth, vanadium, ruthenium, platinum, and tellurium.

Tellurium shows a remarkable curative action but its use is limited by the fact that it forms methyl-tellurium which is excreted by the lungs and imparts a strong garlic odor to the breath. It also causes blanching of the hair and pigmentation of the skin.

These eight metals are all feebly electropositive or feebly electronegative. Their polarization tension is generally lower than that of hydrogen, and they do not decompose water at room temperature.

Other metals, however, such as copper and palladium, possess these same chemical properties but are not spirocheticidal.

EFFECT OF STRAIN ON THE HEART

This subject has been one of great interest and importance, and is ably discussed in the light of recent observations by Paul D. White in the *New England Journal of Medicine* of October 25, 1928.

The direct effects of strain will vary with the kind and degree of the strain and the previous condition of the heart. In the absence of sufficient cardiac reserve, the myocardium improves first in tone, then in bulk; with increasing or persistent strain and decreasing reserve, failure begins. Strain on both ventricles may be shown by such signs as congestion of liver, lungs and neck veins, dependent edema, and finally anasarca with orthopnea and cyanosis. If the strain is unilateral the hypertrophy and dilatation may be unilateral for a while. For example, in aortic valve disease, chronic hypertension or coronary disease, especially in thrombosis of the descending branch of the left coronary artery, the hypertrophy and dilatation is largely limited to the left ventricle. Failure in such cases is shown by dyspnea, pulmonary edema, and general slowing of the peripheral circulation accompanied by edema of the feet. If the failure is acute, cardiac asthma may occur, probably due fundamentally to the inability of the left ventricle to take care of the blood being sent to it by the more vigorous right ventricle.

When the dilatation and hypertrophy are largely right sided, one finds engorgement of neck veins and liver; ascites and anasarca finally develop. When right ventricular failure is added to left ventricular failure some of the dyspnea and pulmonary edema may actually decrease, but signs of right ventricular failure are added.

White lists the various factors causing strain and describes in precise detail the mechanism by which these strains are brought about. He lists the factors as follows:

A. INTRINSIC FACTORS**1. Valvular disease:**

- (a) *Mitral disease*.—Stenosis is more serious, puts a strain on the left auricle and right ventricle, both of which may become large and fail, resulting in auricular fibrillation.
- (b) *Aortic valve disease*.—Regurgitation is more serious. The strain is primarily on the left ventricle. Stenosis sometimes is a favorable complication.
- (c) *Tricuspid valve diseases*.—Is rare. Acts on right heart whether stenotic or regurgitant.
- (d) *Pulmonic valve disease*.—Is uncommon. Acts on right ventricle whether stenotic or regurgitant. Congenital pulmonic stenosis of high degree is very serious.

2. *Congenital defects of heart*.—Degree of strain varies in proportion to the cyanosis.

3. *Pericarditis*.—The speed of accumulation of effusion may make a great difference in the strain.

4. *Coronary disease*.—Acts as strain by decreasing blood supply.

5. *Myocardial disease*.—If acute, as from diphtheria or rheumatic fever, may precipitate failure and death.

6. *Disease of the great vessels*.—Arteriovenous aneurysms cause left ventricular enlargement.

7. *Disturbances of rhythm*.—Paroxysmal tachycardia, through the speed of the heart may impose a burden on both ventricles.

B. EXTRINSIC FACTORS

1. *Hypertension*.—The higher and more persistent the pressure, the greater the strain. Primary effect is on left ventricle.

2. *Hyperthyroidism*.—Cardiac muscle exhaustion from tachycardia and increased pulse pressure.

3. *Exercise and work*.—This is doubtful except in hearts already diseased.

4. *Accidents*.—This rarely applies except when injury affects the heart directly. If the heart is already diseased, constipation and colitis may cause strain.

5. *Pregnancy*.—This is no strain on normal hearts; but mitral stenosis, marked aortic regurgitation, marked cardiac enlargement of auricular fibrillation make termination of pregnancy advisable.

6. *Obesity and overeating*.—Important only for diseased hearts, but are associated often with conditions like hypertension and coronary disease.

7. *Infectious diseases*.—Do not exert any particular strain on normal hearts, unless they actually cause heart disease, as in diphtheria and scarlet fever.

8. *Disease in other organs*.—Strain usually of slight degree, as from pressure or displacements. Right ventricle work may be increased by pulmonary disease.

9. *Anemia*.—Myocardium directly affected if anemia is severe.

10. *Nutritional diseases*.—Beri-beri may cause myocardial weakness.

11. *High altitudes*.—Normal hearts little affected below 10,000 feet.

12. *Anesthesia and operations*.—The effect here is primarily on the nervous control of the circulation.

13. *Forced fluids*.—This may lead to congestive failure. The "beer heart" in Europe is an example.

14. *Alcohol, tobacco, coffee*.—In moderation, the effect is only that of transient irritation.

15. *Nervous strain*.—Hypertension and presenile arteriosclerosis are increasing. This may be due to nervous excitement caused by telephone, automobile, business and intense social competition, etc.

A SIMPLIFIED BEDSIDE BLOOD-SUGAR METHOD

A method for blood-sugar determination which may be used aboard ship or at places where a well-equipped laboratory is not at one's disposal, has been perfected at the Carmichael Medical College, Calcutta, by Dr. Harendra Nath Mukherjee, who describes the method in the Indian Medical Gazette of November, 1928.

The advantages of the method are:

1. No special apparatus is necessary.
2. The finger-prick method (as in blood counts) supplies sufficient blood.

3. The results obtained are quite accurate for clinical work.

REAGENTS

1. *Tungstic acid reagent*.—This is prepared by diluting a mixture of 20 cubic centimeters of 10 per cent sodium tungstate and 20 cubic centimeters of two-thirds normal sulphuric acid to a volume of 1 liter with distilled water. Add a little toluene as a preservative.

2. *Potassium ferricyanide solution*.—Two-tenths of 1 per cent solution in distilled water. The solution should be kept in the dark.

3. *Sodium cyanide-carbonate solution*.—Prepared by dissolving 8 grams of anhydrous sodium carbonate and about 1.5 grams of sodium cyanide in 500 cubic centimeters of distilled water.

4. *Ferric sulphate solution*.—Thirty grams of gum arabic is dissolved in about 600 cubic centimeters of water by heating on the water bath. Five grams of ferric sulphate is dissolved separately in 75 cubic centimeters of 85 per cent phosphoric acid and 100 cubic centimeters of water by means of heat. Allow the solutions to cool and then mix them together and dilute to a volume of 1 liter with distilled water.

5. *Standard glucose solution*.—One-tenth of 1 per cent solution of chemically pure glucose in saturated solution of benzoic acid in water. A little toluene may be added to it.

6. Distilled water.

All these reagents, if kept properly, have good keeping qualities. They can be easily prepared in any chemical laboratory and stocked for later use.

APPARATUS

1. Four test tubes.
2. Two 25-cubic-centimeter graduated cylinders (of the same size and make).
3. One mark capillary pipette with attached rubber tubing and mouthing. (A W. B. C. pipette will do.)
4. A glass beaker to serve as a water bath.
5. One alcohol lamp with tripod stand.
6. Strips of filter paper.

ESTIMATION OF BLOOD SUGAR

With the pipette draw the standard sugar solution (0.1 per cent) up to the mark. (If a haemocytometer pipette is used it is quite sufficient to draw up to the 0.5 mark.) Wipe off the outside of the pipette with a piece of filter paper. Blow out the sugar solution completely on a small piece of filter paper. Put this piece of filter paper in a test tube marked "S." It is not necessary to wash the pipette after this. With the same pipette draw blood up to the same mark in the usual way from a finger prick. Wipe off the blood on the outside of the pipette with a piece of filter paper. Then blow out the blood completely on another small piece of filter paper. Put this piece of filter paper in a test tube marked "U." We have now exactly the same volumes of the standard sugar solution and of blood in the two test tubes S and U. If the pipette of Sahli's haemoglobinometer is used this volume is only 20 cubic millimeters (i. e., one-fiftieth of a cubic centimeter).

Put the two test tubes U and S in the boiling-water bath for two minutes. Then with a graduated cylinder add about 5 cubic centimeters of the tungstic acid reagent to each of the test tubes. Allow to remain in the boiling-water bath for five minutes. Then take them out and by means of a glass rod or a clean piece of wire remove the pieces of filter paper. Care is taken to remove

as little of the liquid as possible with the filter paper. Not more than three or four drops are lost in this way, which is negligible from a practical standpoint. To each of the test tubes then add with a graduated cylinder 1 cubic centimeter of the potassium ferricyanide solution and 1 cubic centimeter of the carbonate cyanide solution. Put the test tubes in the boiling-water bath again and allow to remain seven to eight minutes. Then remove and cool. Add 3 cubic centimeters of the ferric sulphate solution to each of the test tubes. Mix by gentle shaking and let them stand for five minutes when the color of the Prussian blue develops.

Pour the contents of the test tube marked "S" into one of the graduated cylinders and mark it "S." Similarly pour the contents of U into the other cylinder and mark it "U." Dilute both S and U up to the 10-cubic centimeter mark by adding a few drops of water if necessary.

The intensity of color in each cylinder is proportional to the amount of sugar present.

Calculation.—The sugar is determined colorimetrically by what is known as a "test-tube colorimeter"—a well-known procedure when a regular colorimeter is not available. If the color of the solutions S and U match each other exactly when made up to the same volume, then U contains the same amount of sugar as the standard S; i. e., the blood sugar in this particular case is 0.1 per cent. If the color of U is deeper than that of S, then go on diluting U by adding water drop by drop carefully till the colors of S and U match correctly. The blood sugar is given by the following formula:

Blood sugar (in per cent) =

$$\frac{\times (\text{dilution or total vol. of solution in "U"})}{10 (\text{total vol. of solution in "S"})} \times 0.1.$$

SPINAL ANESTHESIA

While spinal anesthesia can not be considered at all new, having been first performed in 1885, it is true that it has only come into wide use since many of its former dangers have been removed during very recent years. Many surgeons are still loathe to use it at all, through their fears of the attending accidents; while others employ it almost as a matter of routine in its present generally accepted field. For example, at the Haitian General Hospital, Port au Prince, for more than a year it has been a strictly routine method in all urological (except kidney) work, and in most of the perineal and lower extremity operations.

In deciding upon its use one likes to keep in mind the several advantages and disadvantages. These are well summed up by J. K. Avent in the New Orleans Medical and Surgical Journal of October, 1928.

He is evidently an ardent protagonist as he is using the method extensively at higher levels than many surgeons would care to risk injecting except in cases where general anesthesia is strongly contraindicated. He is using ephedrin sulphate (50 milligrams subcutaneously) 20 minutes before the spinal puncture, in order to

avoid blood pressure falls; and also uses adrenalin (15 minims intravenously) when there is an alarming blood-pressure fall.

Among the disadvantages and advantages mentioned are:

DISADVANTAGES

1. It may require resuscitation measures, which should be at hand.
2. Certain patients are bad risks, notably those in shock or collapse, those having blood pressure below 100, and those having pleural effusions or new growths.
3. Obese and elderly patients have a greater fall in blood pressure.
4. No absolutely safe drug for spinal anesthesia has yet been found.
5. Neurotics may blame some of their postoperative symptoms on spinal anesthesia.

ADVANTAGES

1. Perfect and complete anesthesia in nearly all cases.
2. Bowels lose their tendency to crowd the operative field.
3. Normal diet restored earlier.
4. No vomiting or other gastric disturbances. No lung and kidney complications.
5. Operative and postoperative risk is reduced to a minimum.
6. Cheapens and reduces operating-room work.
7. It is an ideal anesthetic for tubercular patients who do not have low blood pressure.
8. It is of special value in high blood pressure patients.
9. Hastens the operation.

DRINKING WATER FOR TRAVELERS IN THE TROPICS

That there may be many circumstances which render impracticable the use of the Lyster bag or chlorination by calcium hypochlorite is well brought out by George C. Shattuck in the *Journal of Tropical Medicine and Hygiene* of September 15, 1928.

During expeditions, covering about a year in Liberia and the Belgian Congo, boiling and several methods of chlorinating were tried. Boiling was preferred when clear water was not available, because turbid water neutralized a large amount of chlorine.

Calcium hypochlorite was found unsatisfactory by various methods because of deterioration, even when packed in amber-glass ampules. Halazone tablets proved sufficiently stable for practical purposes.

When the water is very muddy, Doctor Shattuck believes that sedimentation by crystalline potassium or ammonium alum is the best method to employ. In case the water is extremely muddy, so much alum might be required that the water would be rendered acid, but

this could be remedied by the later addition of the necessary amount of sodium carbonate or calcium hydroxide. The clear water could then be poured off and boiled or chlorinated.

The expedition included eight whites in Liberia and seven in the Belgian Congo, none of which contracted dysentery or suffered from severe diarrhea. /

THE USE OF CRUDE OIL AS THE LARVICIDE OF PREFERENCE ON THE ISTHMUS OF PANAMA

The proceedings of the medical association of the Isthmian Canal Zone for 1927 contains an article by D. P. Curry, assistant public health officer of the Canal Zone, in which he sets forth the reasons for preferring crude oil in antimosquito work there. These reasons of course apply as well in places where similar conditions exist.

Where it is impracticable to eliminate the water in which breeding may occur there is need for a larvicide that is safe, efficient, cheap, and easily applied.

It was found that by heating the oil to a proper temperature it would become sufficiently fluid to pass through the spray apparatus in a fine mist which filmed perfectly and spread widely upon the water.

The objection to Paris green in Panama is that there is no road dust available for a diluent; it is difficult to keep the Paris green dry during the wet *Anopheles* breeding seasons, and even the vegetation growing out of the water is constantly so wet that the Paris green would adhere to the leaves and stalks instead of reaching the surface of the water.

Hot oil is sprayed along the shore line of the lakes by means of a hand pump drawing oil from a tank mounted in a rowboat. This is done at 10-day intervals and is practically 100 per cent effective against all *Culicinae*, even those breeding among the floating *Pistia* which abound in parts of the lakes. The cost of the oil delivered to the water's edge is only about 3 cents per gallon. Dense grass and other vegetation offer no serious bar to the success of the method.

Should it ever become necessary to control *Anopheles* breeding in the large coastal swamps of the Atlantic side of the Isthmus, the use of Paris green dusted from airplanes might be a cheap method of satisfactory control. Thus far, however, relatively small parts of these vast areas have revealed *Anopheles* larvæ other than those of *Apicimacula* and *Punctimacula*. The chief malaria carriers are found in limited areas and under conditions as to sunlight and food that are not common in these swamps.

SPLEEN AND PARASITE RATES AS MEASURES OF MALARIA

In the January, 1929, number of the *BULLETIN*, P. W. Wilson showed in his report on a malaria survey in Haiti the very wide discrepancy between the splenic and parasite rate among Haitian negroes. As the parasite rate was in adults almost seven times as great as the splenic rate, and in children about twice as great, it became clear that the parasite rate was much to be preferred in survey work.

H. C. Clark, writing in the *American Journal of Tropical Medicine* of September, 1928, has also reported on this survey which was conducted by him and Doctor Wilson. He notes that of the 2,585 adult negroes whose blood films were positive for parasites, only 110 had palpable spleens. Thus 2,475 men with malaria would have been overlooked had the spleen index alone been employed. Of 1,102 Haitian negro children examined, 462 had positive blood films, only 175 of these having palpable spleens. Thus 287 children with malaria would have been missed by use of the spleen index only.

Clark's work in the Latin American countries indicated that the splenic index in those countries followed more closely the actual malarial incidence than in Haiti, the spleens of Latin American races showing a greater degree and more permanent reaction to malarial infections than the spleens of West Indian negroes do.

Since it may be true that the descendants of the African race do not respond to the malarial stimulus to the same degree that the natives of Central America do, Clark believes that this feature would tend to show that malaria was imported to the Caribbean area during the days of the slave trade.

ELEPHANTIASIS

Medical officers serving in tropical countries will find much of interest and value in a monograph on elephantiasis by A. P. Bertwistle and A. L. Gregg in the *British Journal of Surgery* of October, 1928.

These authors believe that the nontropical forms are usually caused by streptococcal infection with thrombosis, but mention other factors which may obstruct venous and lymphatic flow, such as extensive dissection of lymph glands, tuberculosis, syphilis, leprosy, granuloma inguinale, and infective lymphangitis. In the filarial form they think the parasite alone does not cause obstruction, but predisposes to secondary infection, organisms occasionally present in the blood stream invading the dead worm and devitalized tissues. "The precarious life of the parasites and the prevalence of septic foci make elephantiasis in filarial countries a disease of great frequency;

whereas the rarity of the combination of venous obstruction, lymphatic stasis, and streptococcal infection accounts for the small incidence of the disease in nonfilarial countries."

In the treatment of early nonfilarial cases one should attend to such infectious foci as teeth, tonsils, appendix, and pelvic and urinary infections. Elevation of affected extremities and application of elastic stockings or bandages are essential parts of the treatment. "Massage of the affected part in the absence of inflammation will do much in restoring the vitality of affected tissues; it should be deep and vigorous."

Case reports with photographs in this article show what gratifying results may often follow the Kondoléon operation. This operation is based on Kondoléon's observation that the thickening is limited to the skin and subcutaneous tissues and on the fact brought out by Sappey in 1874 that "the deep fascia forms an impenetrable barrier to the exchange of lymph between the superficial and deep lymphatic systems." The curative principle, therefore, is to remove long strips of deep fascia and thus establish communication between the deep and superficial lymphatics.

The technique for the lower limbs as slightly modified by Sistrunk is as follows:

An external incision is made from the external malleolus to the great trochanter of the femur, and an internal one from the internal malleolus to the mid-Poupart line, no attempt being made to preserve the internal saphenous vein. A large slice of œdematous skin and subcutaneous fat is removed, and the aponeurosis removed, three fingers in breadth throughout the length of the incision. The skin is then sutured in contact with the muscles, leaving no provision for drainage. The operation is conducted in stages. The wounds were found to heal readily, a point in favor of the view that there are no streptococci lying quiescent in the tissues but that they are intermittently deposited there. Later Sistrunk advised removal of redundant skin. He reports 31 cases with excellent results.

In the December, 1928, number of *Surgery, Gynecology, and Obstetrics* appears an article by Gary R. Burke on Results in Porto Rico of Kondoléon Operations for Elephantiasis of Extremities. He reports his results in 16 cases where the Kondoléon operation was done, and believes that:

1. The operative risk for the limb is greater when both sides of the legs are operated upon at the same time. The greater safety to the patient would seem to justify the two-stage operation.
2. Cases in which the foot as well as the leg is involved give poor results, even when the incision is made down to the toes.

3. If the subcutaneous tissue is extremely hard, very troublesome hemorrhage may develop and materially increase the danger of shock.

4. The periods between attacks of lymphangitis are lengthened in the majority of cases. In one case the attacks disappeared entirely for a period of two years, while one patient developed attacks of lymphangitis after operation.

5. Social status plays an important part in the end results. Patients who work on their feet many hours a day have poorer end results than do those who are not compelled to do hard manual labor.

6. A rubber stocking worn during the day is a great aid if not an essential feature in combating the return of swelling following operation.

7. Results in Porto Rico for the Kondoléon operation for the care of elephantiasis have been discouraging.

OROYA FEVER

In 1870, during the construction of the trans-Andean railway, an acute, febrile disease killed many thousands of laborers in the region between Lima and Oroya.

In *Science* (Vol. LXVIII, Nov. 23, 1928), the late Hideyo Noguchi and his associates of the Rockefeller Institute have discussed many of the interesting features of this disease which have been brought to light since it attracted so much attention in 1870.

Because of the frequent association of Oroya fever and verruga peruana in the same individual and the common geographical distribution of these two conditions, the question of their identity became a controverted point. To settle this point, a medical student, David Carrion, in 1885 inoculated himself with tissue juice taken from "verrugas." He developed Oroya fever and died. The condition has often been called Carrion's disease since that time.

In 1905 a Peruvian physician, Barton, discovered the rod-shaped bodies in the red blood cells of verruga and Oroya fever patients. These were named *Bartonella bacilliformis* by the commission of the Harvard School of Tropical Medicine in 1913. These bodies were regarded as protozoa by this commission. The verrucous disease was transmitted by inoculation from man to monkey in 1909.

In 1925 Dr. T. S. Battistini, a Peruvian fellow of the Rockefeller Foundation, collected blood from a case of Oroya fever and brought it in citrate solution to the Rockefeller Institute, where Noguchi cultured the organism from it and inoculated monkeys from the cultures. The monkeys developed both Oroya fever and verruga. A preliminary report on the cultivation of the microbe of Oroya fever was published by Noguchi and Battistini in *Science* (LXIII: 1625, 1926). This was abstracted at length in the *BULLETIN* of July, 1926.

The mode of infection was an essential point which remained to be established. In 1913, Charles H. T. Townsend, an American entomologist, considered all kinds of blood-sucking insects found in the verruga zone, and after excluding all insects whose range extends outside the verruga zone, he reduced the possible carriers to buffalognats, horseflies, and phlebotomi. By excluding insects which bite by day as well as by night, he reduced the possible verruga vectors to phlebotomi alone, and felt so certain of his discovery that he called the gnat "*Phlebotomus verrucarum*."

In 1927 the Rockefeller Foundation sent R. C. Shannon, an entomologist, to Peru to study the insect life and to collect specimens in the verruga zone for purposes of inoculation. It was found that the females of *P. verrucarum* Townsend and of *P. noguchii* are carriers and that *P. peruensis* is probably not a carrier. Many other insects were tested but found not to harbor *Bartonella bacilliformis*.

The plan followed was to inject saline suspensions of the crushed insects into the skin of *rhesus* monkeys. No verrucous nodules developed. At regular intervals thereafter cultures were made from the blood of the inoculated monkeys with a view to determining whether the *Bartonella* had entered the blood and multiplied in it. Four different lots of phlebotomi, as tested in this way, were proved to carry *Bartonella bacilliformis*. In the first instance the culture was obtained with blood withdrawn from the inoculated monkey on the nineteenth day, in the second on the twentieth day, in the third on the tenth day, and in the fourth on the forty-second day. The inoculation of monkeys with the cultures thus obtained produced experimental verrucous nodules, with recovery of the *Bartonella* from the blood and the nodular tissue. The chain of evidence uniting *Phlebotomus* with Oroya fever and verruga peruana may be said to have been completed by these tests.

SAFETY STANDARDS OF PROTECTION AGAINST X-RAY DANGERS

The most important questions in the every-day life of the worker in the field of X rays are the amount of radiation the human organism can absorb without damage and the amount of protective material required to reduce stray and scatter radiation to within safe limits. Many X-ray departments may appear to be provided with adequate protection for those employed therein but actually be so designed and operated as to expose the personnel to sufficient radiation to cause deleterious effects by cumulative absorption over a considerable period of time.

In a paper published in *Radiology*, June, 1928, A. Mutscheller, Ph. D., proposes a safety standard of X-ray absorption which he

claims has been accepted by German and British workers. This standard is one one-hundredth erythema dose per month.

In determining the amount of protection necessary to keep within the protection tolerance dose Mutscheller has taken the possible stray and scatter radiation intensities from the following working conditions as representing the maximum encountered in the average busy laboratory each working day:

(A) For radiography, 50 exposures of an average of 5 seconds with 20 milliamperes (average, 0.35 angstrom).

(B) For fluoroscopy, 2 hours' exposure with 4 milliamperes (average, 0.30 angstrom).

(C) For surface therapy, 10 hours' exposure with 4 milliamperes (average, 0.25 angstrom).

(D) For deep therapy, 10 hours' exposure with 4 milliamperes (average, 0.14 angstrom). To provide protection adequate to keep the stray and scatter radiation within the limits of the tolerance dose under average working conditions the writer has calculated that the following thickness of lead is necessary:

(A) For radiography, not less than 2 millimeters of lead.

(B) For fluoroscopy, not less than 2 millimeters of lead.

(C) For superficial therapy, not less than 3.25 millimeters of lead.

(D) For deep therapy, not less than 5.6 millimeters of lead.

To test the adequacy of any installation the writer proposes the following simple test:

An ordinary slow Eastman dental film is wrapped in black paper and so exposed to the radiation from a standardized X-ray therapy equipment as to be subjected to one four-hundredth part of an erythema dose. For example, if the equipment is calibrated and it is known that it produces an erythema dose in 70 minutes at 50 centimeters distance, then the film is placed at a distance of 1 meter from the target of the tube and, without changing any filters, it is given an exposure of seventy one-hundredths of a minute, or 42 seconds. This exposure upon the film is equal to 0.0025 erythema dose. Another film is similarly wrapped in black paper and placed where the operator is normally located, or it is carried by him under his clothes on the front of his chest for a quarter of a month, or for eight days. The films are then developed together, but the developing process is interrupted after the lapse of about four-fifths of the normal developing time. This is done to avoid chemical fogging of the films. If the film carried by the operator for a fourth part of a month shows more darkening than the standard film which received a fourth of one one-hundredth part of an erythema dose, then the tolerance dose of one one-hundredth of an erythema dose per month is exceeded and the protection appears inadequate. Con-

versely, if the film is equal in tint or lighter than the standard exposed film, then the protection furnished by the equipment can obviously be considered as safe. In order to exclude the possibility of films being fogged otherwise, it may be advisable to wrap a thin strip of lead foil all around a quarter part of the film. If the films are not fogged and the developing process is carried out correctly, then this part of the film should remain absolutely clear.

Whether or not one one-hundredth erythema dose per month is a safe limit for the tolerance dose can not be definitely stated at this time. However, in view of the fairly general agreement among the many investigators who have studied this problem it would appear to be reasonably safe to set this as the maximum tolerable dose and provide protection accordingly. The protection and conservation of the health of the personnel of the X-ray service is not alone a matter of so many millimeters of lead applied in a certain manner but equally important is a generous amount of time for rest and recreation away from radiation, preferably in the open air and sunshine. The rate of loss of radiation effect on the human organism is considerably influenced by the physical condition and habits of the individual, therefore, that which tends to promote general health will probably increase the rate at which the body recovers from the effect of prolonged accumulated radiation.

MEASUREMENT OF EFFECTIVE WAVE LENGTHS OF X RAYS

The International X-Ray Unit Committee at their last meeting at Stockholm in July, 1928, made the provisional recommendation that for practical purposes the quality of X radiation be expressed by stating the half-value layer in a suitable material, or by stating the effective wave length as determined by the percentage amount of radiation transmitted through a given thickness of suitable material such as copper or aluminum. The two methods selected are easily within the ability of Röntgen therapists and were probably chosen because of the simplicity of either method. The determination of effective wave lengths requires the use of a reasonably accurate ionization chamber which should be included in the equipment of every laboratory doing X-ray therapy.

Duane, Hudson, and Sterling, in an article published in the American Journal of Roentgenology and Radium Therapy, September, 1928, present a very simple method for determination of effective wave length by percentage amount of radiation transmitted through given thicknesses of aluminum and copper. This is the same method advocated by Duane several years ago, but is based on somewhat more accurate measurements, and effective wave lengths have been

added for the longer wave radiation of the "infra-Röntgen" portion of the spectrum. Effective wave length charts for radiation from approximately 0.12 angstrom units to 2 angstrom units are given, and a table showing the relation between various voltages, filters and effective wave lengths determined with both aluminum and copper is presented with the paper.

Since any specification of dosage in X-ray therapy is incomplete without specifying the quality of the radiation used, the method proposed by Duane appears to be entirely practical for this purpose, and it is expected that future custom will include an exact description of all of the various factors entering into the dose in X-ray therapy.

THE SATURATION METHOD IN RÖNTGEN THERAPY AS APPLIED TO DEEP-SEATED MALIGNANT DISEASE

In general it appears there are two schools of thought in the application of Röntgen therapy in malignant diseases. One, mostly European, advocates the administration of the entire tolerable dose at one application with long periods of rest before repeating the dose; this is the so-called "massive dose technique." Another school advocates the administration of the dose over a period of several days until the maximum effect (100 per cent dose) has been attained, and this maximum effect is maintained for a period of 10 days to two weeks by daily administration of sufficient radiation to replace that lost; this is known as the "saturation method."

Dr. George E. Pfahler, of the Post Graduate School of the University of Pennsylvania, presents a paper in the September, 1928, issue of the American Journal of Roentgenology and Radium Therapy, in which he supports the saturation method in Röntgen therapy. This paper confirms the observations of Doctor Pfahler made two years previously in regard to the saturation method, and in his opinion the test of time has proven the advantages of this method. The advantages claimed are: "(1) By delivering the maximum radiation in the shortest practical period of time, one obtains all the advantages of the single massive dose in its destructive effect upon the malignant cells. (2) By continuing this maximum effect for 10 to 14 days thereafter, one may expect to irradiate all cancer cells during the process of division. (3) By somewhat dividing the dose, one avoids the profound radiation effect upon the general organism. (4) In his experience the saturation method has given better clinical results than has been obtained by any other means. This statement is based on Doctor Pfahler's radiotherapeutic experience of over 25 years." The disadvantages are stated to be: "(1) Much more time is consumed in the repeated arrangement of the patient for multiple exposures and

thereby the total expense of treatment is increased. (2) Great caution is necessary to avoid overdosage from cumulative effects. (3) There is more opportunity for the patient to interrupt the treatment before all diseased cells have been destroyed. (4) It is difficult at present to determine how long this saturation effect must be maintained in the individual case. Sometimes it seems advisable to add more treatment after two months if any evidence of disease remains, but such addition involves the risk of secondary degeneration and the cumulative or total value must be kept constantly in mind in relation to the amount of tissue irradiated and the condition of the circulation within that tissue."

As in all methods of Röntgen therapy, Doctor Pfahler lays particular emphasis on the full understanding of the quality and quantity of radiation, the rate of absorption at various depths, the rate of loss of radiation effect, and the clinical aspect of each individual case.

A STUDY OF ENDEMIC PELLAGRA IN CERTAIN SOUTHERN STATES

For more than 20 years the Public Health Service has been conducting studies of pellagra. As a result of these investigations it has been shown by Dr. Joseph Goldberger and his associates of the Public Health Service, that pellagra is a disease of dietary deficiency. Methods of prevention and cure of this disease have also been pointed out.

A recent publication issued by the Public Health Service (Hygienic Laboratory Bulletin No. 153) contains some very interesting data collected in connection with a study of endemic pellagra in some cotton-mill villages of South Carolina.

As a part of the field investigations of pellagra conducted by the Public Health Service there was begun in the spring of 1916 a study of the relation of certain social, hygienic, sanitary, and economic factors to pellagra incidence in some representative South Carolina textile-mill communities, so-called cotton-mill villages, in which the disease was believed to be endemic. On a varying scale, but without interruption, this study was continued until the fall of 1921; that is, during a period of about five and a half years.

The results of the first year's study have already been published. In the present communication, much delayed by, among other reasons, the pressure of other continuing studies, there is recorded certain of the results of that phase of the subsequent study concerned with the incidence of the disease and the relation of this incidence to certain social, climatic, sanitary, economic, and dietary factors.

During 1917 in an aggregate population of 22,653 individuals, 1,147 cases of pellagra (an incidence rate of 50.6 per 1,000) were

observed. Of the 4,104 households among which that population was distributed, 18.5 per cent had at least one member affected by the disease in that year.

Pellagra (in an endemic locality) is very much (two to six times) more prevalent than the experience of the physicians of the locality would seem to indicate.

The fatality rate of the endemic disease, when definitely marked cases of all grades of severity are considered, would appear not to exceed 3 per cent.

Striking peculiarities of age and sex distribution of the disease were observed.

The observations of age incidence appear to indicate, what seems not to have been recognized heretofore, that endemic pellagra is preponderatingly a disease of children of from 2 to 15 years of age.

Explanations of the peculiarities of age and of sex incidence are suggested.

The single woman, as compared with the married, widowed, or divorced, is relatively exempt from the disease. In the population group under consideration, the single woman is usually a wage earner, which may place her in a somewhat more advantageous position with respect to diet than her married or widowed sister.

The incidence of the disease was found to be markedly seasonal; 80 to 90 per cent of all cases had their "onset" within the period April to July, inclusive. One explanation suggested, in view of the proved dietary relation of the disease, is the variation in diet brought about by the seasonal modification of the food supply.

The seasonal incidence of cases distinguished by their occurrence singly or otherwise in a household, and as initial and recurrent attacks, was studied.

The disease was found to have a marked and very sharply limited season of prevalence the curve of which, with a slight lag, paralleled that of incidence.

The study failed to disclose any consistent correlation between sanitary conditions and pellagra incidence. Such association as may at times be observed is regarded as accidental and to be explained by the intimate relation of the endemic disease to economic status, of which the sanitary condition may be an index.

The study reveals the existence of a striking inverse correlation between the incidence of the endemic disease and family income.

The continuous study of a selected village during a period of nearly six years appears to demonstrate that income shortage was a fundamental, though indirect, controlling factor in relation to the year-to-year fluctuation in the incidence of the disease. It is therefore inferred that the year-to-year fluctuations in the incidence of the

endemic disease are bound up with fluctuations in economic conditions that influence the ability of a certain section of the population to procure an adequate diet.

Marked seasonal variations in the food supply of a selected village are demonstrated. A relation of this variation in food supply to the striking seasonal incidence and prevalence of the disease is suggested.

**SURGEON GENERAL OF THE UNITED STATES PUBLIC HEALTH SERVICE
REVIEWS WORLD HEALTH CONDITIONS AND SUMMARIZES THE WORK
OF HIS BUREAU IN ANNUAL REPORT**

A summary of world health conditions and of the work of the United States Public Health Service is given in the annual report of Surg. Gen. H. S. Cumming just submitted to Congress.

On account of the close relation between modern commerce and the public health with respect to the spread of disease, the Public Health Service keeps informed of the world prevalence of dangerous communicable diseases, and holds two most important lines of national defense against imported infections—examination of intending immigrants abroad in the country of origin and inspection of vessels, passengers, and seamen and the medical examination of alien passengers and seamen arriving at domestic and insular ports of the United States. As a result of this work, there was no importation of any quarantinable disease during the year, despite the fact that smallpox, plague, yellow fever, cholera, and typhus fever were more or less prevalent in endemic localities throughout the world.

In this work of protecting the United States from the importation of dangerous diseases, 21,631 vessels, 1,046,319 passengers, and 1,308,681 seamen were inspected at domestic and insular ports, and 1,178,482 alien passengers and 928,423 alien seamen were examined by medical officers under the immigration law. Seven cases of smallpox, one case of leprosy, and two cases of typhus fever reached the quarantine stations and were detained. Among the more important causes of certification for disease in alien passengers were trachoma, tuberculosis, feeble-mindedness, insanity, and the venereal diseases, while the more important causes among alien seamen were the venereal diseases, trachoma, and tuberculosis.

The Surgeon General states that health conditions were generally favorable throughout the world during the fiscal year 1928. No pandemic outbreaks of any disease occurred and no country with a modern public health organization was affected by the spread of any of the pestilences that have scourged the world in times past. Bubonic plague continued to be pandemic, India continuing to be the world center of plague prevalence. That the disease is widespread,

however, is shown by the fact that cases were reported in French Indo-China, China, Algeria, Madagascar, Nigeria, Siam, Argentina, Ecuador, South Africa, Greece, and Russia. In spite of this world-wide occurrence, there were no cases on the North American Continent, excepting two in California, which were contracted from the infection in ground squirrels in that State. The Surgeon General points out that these squirrels constitute a perpetual reservoir of plague infection and advocates more extensive control measures.

Cholera was more prevalent in India than it had been during the preceding eight years, excepting 1924, and was present in several other parts of the world, principally Siam, Cochin-China, and China proper. Many Chinese ports were reported as infected during the year. An extensive epidemic of cholera also occurred in Iraq.

Yellow fever reappeared in west Africa in June, 1928, after several months' absence. Some months earlier cases had been reported at various places in Africa, including Senegal, Togoland, Dahomey, the Gold Coast, and the Belgian Congo. An epidemic of yellow fever developed at Rio de Janeiro, Brazil, during 1928, and the disease was reported at several other ports and from places in the interior.

The typhus-fever situation in Europe continued to improve, although a marked outbreak occurred in Morocco in the latter part of 1927 and early in 1928.

"Smallpox," says the Surgeon General, "continues to be unduly prevalent in spite of the fact that an efficacious method of prevention is known. The disease is reported from practically every country of the world." He points out that again the United States has the unenviable distinction of reporting more cases of smallpox during the year than any other country in the world from which reports are received, except India, and says:

"It is difficult to understand why this condition is allowed to continue year after year. A large percentage of the property in this country is insured against loss by fire, and a man who fails to provide for his family by taking out life insurance is censured; yet, when smallpox is introduced into a community in the United States it usually finds many victims who have never been vaccinated and others who have not been vaccinated for many years. Nearly 34,000 cases of smallpox in the United States in the calendar year 1927, testify to the neglect of the people to utilize vaccination, the known means of preventing the disease."

A widespread outbreak of infantile paralysis occurred in the United States during the summer of 1927. The serious after-effects of this disease make it more to be dreaded than other diseases which cause many more cases of illness and even have a higher death rate.

The Surgeon General calls attention to the importance of proper after-care in infantile paralysis.

Measles caused nearly 4,000 deaths in 41 States in 1927, a little more than half the number of deaths recorded for this disease in the preceding year. Measles is a disease that fluctuates widely from year to year. Whooping cough caused nearly 7,000 deaths in 42 States in 1927, and is, therefore, not the harmless disease it is generally considered.

An increase in the number of deaths from pellagra was reported in the lower Mississippi Valley region, consequent upon unfavorable industrial and economic conditions following the flood.

The death rate for influenza and pneumonia was unusually low in the United States during the calendar year 1927, the decrease in these important causes of death having contributed materially to the low general death rate for the year.

For several years prior to 1921 the case and death rates for diphtheria had been rising; but from 1921 to 1926 there was an improvement in the diphtheria conditions, while there was increased prevalence again in 1927. The case rate had begun to drop again toward the end of the present fiscal year.

In addition to the prevention of the importation of disease and the prevention of epidemics in the United States, the United States Public Health Service is authorized by law to investigate diseases of man, and in this work it not only carries on research in the basic sciences of public health but lends its efforts to the solution of problems of applied public health—the effective economic control of diseases.

Among the subjects of fundamental research were studies of cancer, tuberculosis, goiter, leprosy, trachoma, undulant fever, typhus fever, Rocky Mountain spotted fever, pneumonia, and the venereal diseases. These studies were carried on by workers connected with the hygienic laboratory of the Public Health Service, which has become recognized throughout the world by its scientific research work in public health. Special studies were also made throughout the year on health problems in industry, child hygiene, and stream pollution.

In 150 ports of the United States, Alaska, and the insular possessions hospital and out-patient treatment was furnished during the year by the United States Public Health Service to American merchant seamen and other legal beneficiaries to the extent of 1,354,545 patient days in hospital and 638,794 out-patient treatments. A total of 349,199 persons applied for medical service. It is an interesting commentary on the incidence and cost of venereal diseases to note in the report that these diseases comprised 18.7 per cent of the total admissions and were hospitalized at a cost of \$812,096.

The personnel of the Public Health Service, consisting of a corps of medical and dental officers, sanitary engineers, pharmacists, nurses, specialists, and other technical and nontechnical employees, at mid-year 1928 consisted of 1,174 medical officers and persons of other scientific ratings and 3,586 general and technical employees.

THE ASSOCIATION OF MILITARY SURGEONS

During the past few years membership in the Association of Military Surgeons of the United States has been growing at a rapid rate among all classes of those who are eligible, with one exception. The exception, unfortunately, is that class composed of naval medical officers. Navy membership in the association has decreased. Some of this decrease has been due to resignations, but even more of it has been due to members being dropped for failure to pay their dues. This, of course, should not be, and it is not believed that any naval medical officer would intentionally allow himself to become so far in arrears as to justify his being dropped from the rolls of any organization to which he belongs. The fact remains, however, that Navy members are being dropped for this reason. It seems probable that the failure to pay is due to one of two things—carelessness or lack of interest. If it be the first, simply calling attention to the fact that a member is delinquent will be sufficient. If it be lack of interest, a better understanding of the organization and its aims will correct this.

The membership of the Association of Military Surgeons of the United States is made up of those who are now, or have been, commissioned officers in the Medical Department of the Army, the Navy, the Public Health Service, the National Guard, and the Reserve. In addition, members of the medical service of the United States Veterans' Bureau, members of the Air Service Medical Association, and members of the Medical Veterans of the World War have recently become eligible for membership. In other words, its membership is composed of men whose chief aim is to promote the efficiency of military medicine—and this includes naval medicine.

That the efficiency of the medico-military service of the United States may best be increased by members of all its components coming together for conference and study of interlocking problems is a truism.

The Association of Military Surgeons of the United States is the only organization in our country which affords an opportunity for this getting together, and for this reason, if for no other, should be liberally supported by naval medical officers. In fact, naval medical officers who wish to get the most out of their service, and to give their

best to their service, must, of necessity, belong to it and make use of the advantages that arise from such membership.

It is frequently stated that little of interest to medical officers of the Navy is published in *The Military Surgeon*, the official publication of the organization. It is true that little which applies only to the Navy appears in its pages. But it is also true that much which applies to land warfare, to camp sanitation, to medico-military history, and to organization of troops applies equally to the problems of naval medicine, and a knowledge of these must be of value to the naval medical officer.

The cost of membership in the association—\$3 a year—is too small to be considered, when the value of membership is understood.

Another feature of membership which alone is worth far more than the cost is the opportunity that is presented at the annual meetings for medical officers of all branches of the military services of the United States to mingle in fellowship. Much good is accomplished by the informal gatherings that form such a prominent part of these meetings, and medical officers return from them with a new and better understanding of the problems of their sister services and in a better position to cooperate with them should the occasion arise.

It is hoped that those naval medical officers who have been dropped from the rolls of the association for nonpayment of dues will reinstate themselves by paying their back dues as soon as possible; that those members of the association who have seemingly lost interest in it may, through increased activity in furthering its aims stimulate anew their own interest; and that the younger medical officers who have never given much thought to the subject may see that by joining the association they will increase their own chances to obtain a knowledge of medico-military matters and thereby make themselves more valuable members of the service to which they belong.

THE AMERICAN PHYSIOTHERAPY ASSOCIATION

The American Physiotherapy association extends an invitation to naval medical officers and physiotherapy aids in the United States naval hospitals to attend the Annual Convention of the American Physiotherapy Association, which will be held this year in Portland, Oreg., July 8 to 12. This is at the same time and place as that of the Annual Convention of the American Medical Association.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington, D. C.
(For review.)

DIAGNOSTICS AND TREATMENT OF TROPICAL DISEASES, by *E. R. Stitt, A. B., Ph. G., M. D., Sc. D., LL. D., Rear Admiral, Medical Corps, United States Navy, formerly Surgeon General, United States Navy; President National Board of Medical Examiners; Member Federal Board of Hospitalization; President Board of Visitors, St. Elizabeths Hospital; Member Executive and Central Committees, American Red Cross; Commanding Officer and Head of Department of Tropical Medicine, United States Naval Medical School; Professor of Tropical Medicine, Georgetown University; Professor of Tropical Medicine, George Washington University; Lecturer in Tropical Medicine, Jefferson Medical College; Associate Professor of Medical Zoology, University of the Philippines.* P. Blakiston's Son & Co., Philadelphia, 1920. Price, \$10

Naval medical officers and all those familiar with works on tropical medicine need only know that Doctor Stitt has completed a new edition of this book. They will require no further information about the book in order to form the opinion that it should be possessed, read, and used as a reference of the highest authority.

This edition will be especially welcomed by workers in tropical medicine the world over, as it is the first revision that has appeared since 1922. It is greatly enlarged, contains 249 illustrations, and is beautifully bound and printed.

There are six new chapters: Melioidosis; food injuries and vitamine deficiencies; injurious plants; common cosmopolitan helminthic infections; injurious arthropods, fish and coelenterates; poisonous snakes.

The chapter on yaws has been practically rewritten, and presents considerable evidence of vital interest and importance which supports the view that syphilis and yaws are identical. Doctor Stitt believes that there is now as much evidence in favor of the theory of identity as there is in favor of the older accepted idea of duality.

The chapter on malaria has been rearranged to include subject matter recently recognized as important, in particular a discussion of the use of plasmochin.

The appendix occupies the latter third of the book and contains some new features of distinct value. This is presented in four sections: Index of clinical diagnosis; laboratory procedures; index of essential laboratory procedures; tropical hygiene. In the Index of Clinical Diagnosis, all symptoms and signs which may occur in tropical diseases are listed alphabetically, each being followed by a thorough consideration of the problem of differential diagnosis which arises with each one of these symptoms.

HISTORY OF MEDICINE, by *Fielding H. Garrison, A. B., M. D., Lieutenant Colonel Medical Corps, United States Army*. Fourth edition, revised and enlarged. W. B. Saunders Co., Philadelphia, 1929. Price \$12

Previous editions of this book have won such a high place among works on the history of medicine that it is now quite superfluous to remark that this new edition is the book of outstanding merit and authority in the ranks of anything yet published in English on the subject.

Even if one read nothing but the preface, the book would more than deserve a place in one's library. Here Garrison sets forth, as only Garrison can do, the value and importance of medical history. His own vision of the field of medicine is so enormous and he has injected so much of this broad view into every page that the reader can no more escape the broadening influence of the book than he can avoid being fascinated by its delightful style.

The author has accomplished through tremendous patience and real skill the production of a combination which is rarely seen—a book of encyclopedic scope and form which at the same time is replete with smooth pleasant reading. This effect is partly brought about by the use of smaller type and footnotes for certain detailed facts in order to avoid destroying the continuity of the narrative.

The history of medicine is becoming an increasingly important part of medical education. It is now taught in 63 academic institutions. Germany has been the leader in this field, there being 15 chairs among her universities. This may be largely due to the masterful work of Karl Sudhoff who in 1905 became the director of the *Institut für Geschichte der Medizin* at Leipzig, and since 1925 the work of his successor to the chair, Prof. Henry E. Sigerist.

The United States is second on the list with nine chairs. Recent movements which have advanced the teaching of medical history in the United States include the establishment of an Institute and Library of the History of Medicine by the Johns Hopkins University, under the direction of Prof. William H. Welch, and the organi-

zation of a course of lectures on the history of medicine by the Mayo Foundation. Prominent among recent literary productions in this field in the United States are Cushing's *Life of William Osler* and Esmond R. Long's *History of Pathology*. The *Annals of Medical History*, edited by Dr. F. R. Packard, is the leading American medico-historical periodical. This very dignified and beautifully printed and bound publication has completed a successful and stimulating decade as a quarterly, and has this year made the significant change of becoming a bimonthly.

Doctor Garrison's new book is all that Dr. James Gregory Mumford said about the story of medicine in reviewing the first edition:

"This story of medicine is vital and inspiring, no matter from what angle you approach it. It is closely interwoven with the story of peoples, of civilizations, and of the human mind. It deals with great men and small men—with philosophers and scientists, with monarchs and ecclesiastics, with scoundrels and humbugs. On the one hand, it springs from folk-ways, legends, credulity, and superstition; and the other from intelligence, culture, labor, valor, and truth. And always it seems to reflect the character and progress of the people with whom for the time it is lodged—be they reactionary or be they progressive. Whatever else it is, the history of medicine is never dull. It is certainly not a catalogue—an arid depository of names and formulas."

The first chapter concerns "The identity of forms of ancient and primitive medicine." The doctrine that all folklore is an essential unity is dealt with here at such length and so convincingly that the reader is left with no doubt as to its truth and soundness. Thus until the era of scientific medicine, and to-day among primitive peoples or those unreached by the influence of advances in science, "the history of medicine is also the history of human fallibility and error."

"The history of the advancement of medical science, however, is the history of the discovery of a number of important fundamental principles leading to new views of disease, to the invention of new instruments, procedures, and devices, and to the formulation of public hygienic laws, all converging to the great ideal of preventive or social medicine; and this was accomplished by the arduous labor of a few devoted workers in science."

Garrison calls the seventeenth century "the age of individual scientific endeavor" and the eighteenth century "the age of theories and systems." He gives crisp biographical sketches of many leading contributors to scientific advancement in these two centuries, such as Harvey, Leeuwenhoek, Malpighi, Descartes, Willis, de Graaf, Sydenham, Linnaeus, Lavoisier, Scarpa, William and John Hunter, Jenner,

and Rush. His treatment of the cultural and social aspects of the seventeenth and eighteenth centuries in their relation to medical practice and advances of the times is a brilliantly handled narrative both enlightening and entertaining.

The nineteenth century is characterized by "the beginnings of organized advancement of science" and the twentieth by "the beginnings of organized preventive medicine." These centuries also had their "cultural and social aspects" of medicine which the author gives an account of in his superb fashion. Since modern medicine is full of personalities familiarly known to us, we are interested in the author's appraisal of these men and their works. One is deeply impressed with the fine sense of values he displays in this connection. His judgments are based almost entirely on actual contributions made, and the extent to which these contributions have advanced the science of medicine toward the several goals to which it aspires. Here are many names not widely familiar, and perhaps unknown to a great number of readers. It becomes quickly apparent, however, why these persons have been given space when we consider how their work has affected the development of modern medicine. Also, we can understand in reading these pages why certain names which for one reason or another have figured prominently in the minds of both the medical and lay public, are omitted and ignored in this volume.

Throughout he has chosen the most apt quotations and aphorisms in describing the characters and events. S. Wier Mitchell and Oliver Wendell Holmes figure largely as sources of these quotations. In speaking of Philippe Ricord, he quotes Holmes who styled Ricord "the Voltaire of pelvic literature—a skeptic as to the morality of the race in general, who would have submitted Diana to treatment with his mineral specifics, and ordered a course of the blue pills for the vestal virgins."

In the modern period there is a classification according to nations and according to fields of medicine. Among the French clinicians we find much said about Broussais, Pierre-Charles-Alexandre Louis, Laennec, Bretonneau, Pinel, Bouillaud, and Corvisart. In Great Britain, those of whom interesting accounts are given are Robert Graves, William Stokes, Bright, Addison, and Hodgkin. The German list includes Skoda, Rokitansky, and von Hebra. The earlier American clinicians were Otto, the Jacksons, North, Ware, the elder Mitchell, Gerhard, and Drake.

Every day we use names which have been given to various surgical methods but which we do not associate in any personal way with the men who introduced these methods. The associations are greatly enriched by the intimate glimpses we get here of such men as John

Bell, Sir Astley Cooper, Abraham Colles, Liston, Syme, Fergusson, Brodie, Dupuytren, Velpeau, Nélaton, Broca, and von Graefe.

Two of the greatest aids to the advancement of surgery are not strictly surgical. These are ether anesthesia, and the X ray. A rabid controversy has surrounded the early history of ether anesthesia, but we are indebted certainly to such surgeons as John Collins Warren and Henry J. Bigelow, who were among the first to use and demonstrate it. Recent surgery, of course, owes a great debt to Wilhelm Röntgen for the X ray.

In the second half of the nineteenth century the more purely scientific side of medicine was advanced by several notables. Garrison helps us spend a pleasant and profitable hour here with Charles Darwin, Thomas Huxley, Haeckel, Mendel, Galton, Waldeyer, Henry Gray, Oliver Wendell Holmes, Max Schultze, Walther Flemming, His, Cajal, von Helmholtz, Henry P. Bowditch, Sherrington, Claude Bernard, W. B. Cannon, Max Rubner, Brown-Séquard, Carl Ludwig, Haldane, A. V., and Sir Leonard Hill, Henry Head, Salkowski, Virchow, Pasteur, Koch, Klebs, Löffler, Metchnikoff, Welch, Flexner, Vaughan, Hektoen, Theobald Smith, Noguchi, and numerous others.

Toward the end of the nineteenth century, medicine in all its branches brought forth names to be reckoned with. A splendid appraisal is given in this section of such men as Bilroth, Thiersch, von Volkmann, Esmarch, Paget, Jonathan Hutchinson, Sir Victor Horsley, Keen, Senn, McBurney, the Mayos, Howard Kelly, Crédé, John Braxton Hicks, Ernst Fuchs, Trousseau, Fournier, Kussmaul, Nothnagel, Henoeh, Naunyn, Gull, Ewald, Allbutt, Osler, Pepper, DaCosta, Abraham Jacobi, Romberg, Charcot, Pierre Marie, Erb, Gowers, and Kraepelin.

The twentieth century, with its organized endeavors in the fields of preventive medicine and social medicine brought forth many great innovations and has already added many names to the hall of immortals.

The statistical science of biometrics has opened many avenues of approach to many problems. This science has been chiefly developed by persons little known to members of the profession who are engaged chiefly in the practical every-day forms of medical pursuit. The leaders in this science have been Francis Galton's brilliant pupil, Karl Pearson; and in the United States, Raymond Pearl, a mathematician of great ability, who is now professor of biometry and vital statistics in the School of Hygiene of the Johns Hopkins University.

The physiologists and physiological chemists have added much to our understanding of biological questions since 1900. Garrison gives a fascinating account of many of these workers and the benefit that

has resulted from their labors. Among others of these may be mentioned Pavloff, Jacques Loeb, Sir James McKenzie, Emil Fischer, Abderhalden, Benedict, Folin, Van Slyke, and Eugene DuBois.

Psychology and psychiatry have made great strides through the help of many, among which may be mentioned Janet, Binet, Freud, Alfred Adler, and J. B. Watson.

The greatest triumphs of parasitology, tropical medicine, and chemotherapy belong to the twentieth century. Garrison is particularly well qualified to write of the developments in the field of parasitology and tropical medicine because of his close association with the circles of military medicine and the Public Health Service, from which came the greater part of the contributions. The persons concerned were many, the ranks of the military and public health people including such names as Laveran, Sir Ronald Ross, Widal, McCarrison, Letterman, Sternberg, Reed, Gorgas, Ashford, Craig, Goldberger, and Nichols.

Philosophers, historians, sociologists and many others will find in the chapter on Cultural and Social Aspects of Modern Medicine a fund of things to ponder on.

The appendices include among other things, a 70-page chronology of medicine and public hygiene.

It is indeed difficult to say in which rôle Colonel Garrison is the greater—historian or philosopher.

PHYSICIAN AND PATIENT, Edited by *Dr. L. Eugene Emerson*. The Harvard University Press, Cambridge, Mass., 1929. Price, \$2.50

Some years ago the Harvard Medical School inaugurated a series of special lectures to students on the personal care of the patient by the physician. From the first, the lectures were a success, partly because they were given by men of great eminence and partly because the time was ripe for a correlation of psychology and medicine.

From these lectures Dr. L. Eugene Emerson has selected nine for publication in *Physician and Patient*. The book sets the official seal of approval by the highest authority possible on the idea that a patient is a person, not a test-tube in a laboratory, or an aggregation of organs, or a mere machine, and is to be cared for accordingly.

Among the authors are such well known physicians as David L. Edsall, C. F. Martin, and W. S. Thayer.

There has been some misapprehension of the value of scientific study in medicine, and in this connection, Dr. Francis W. Peabody, in one of these lectures said that the trouble was not in being too scientific, but in not being scientific enough. The patient had not only a body, but also a mind, and a personality that should be taken care of in sickness.

Doctor Edsall in his chapter on Human Relations of Doctor and Patient traces the origin of our present-day organizations for the care of the sick to the influence of St. Francis of Assisi and the mendicant friars who looked after the sick poor with a spirit of kindly human devotion. He advises students to acquire "more comprehension of the varied psychological processes of humankind by wide reading, particularly of fine romance, poetry, and biography. He stresses the importance of dispelling the patient's fear and tells of how able Osler and William Pepper were in that art, and how much this contributed to their success.

"In the words of Sir John Simon, we belong to a profession that purports not merely to give but to *owe* 'heart as well as brain and hand to the service of even the least of mankind.'"

In a chapter called The Medical Education of Jones, Doctor Thayer narrates the stages of attitude a certain medical student passes through and how he learns the value of certain traditions and ethics in medicine, especially that of not criticizing one's colleagues.

Alfred Worcester has contributed an enlightening chapter on The Care of the Aged in which he has made many helpful suggestions which should add to the comfort and contentedness of elderly patients.

PNEUMONIA, by *Frederick T. Lord, A. B., M. D., Visiting Physician, Massachusetts General Hospital.* Harvard University Press, Cambridge, 1929. Price, \$1.

This very small book contains a very large amount of information on the subject of pneumonia.

In a half hour one can read this little monograph and feel that he has acquired the substance of the latest concepts of pneumonia in the various aspects of the subject—causes, diagnosis, bacterial types, crisis, recovery, and treatment.

It is just the book for the busy man engaged in general practice. Not a word is wasted. There is a careful economy of words used in conveying a clear account of all that matters to the practical doctor. It is particularly well adapted for laymen interested in important health problems.

The author's discussion of the factors underlying crisis and recovery is based on recent advances in this field of investigation and will prove most enlightening to those who have been unable to follow all the literature on the subject.

He speaks very enthusiastically of Felton's antibody solution in the treatment of Types I and II. There is strong evidence of the value of this serum in the fact that it is capable of creating a positive balance of protective bodies in the blood at an early period of the disease when these are not ordinarily present.

A recent discovery of importance has been made in connection with the public health phase of this problem. While the pneumococcus is an inhabitant of the normal mouth, pneumococci of Types I and II are found as a rule only in the mouths of pneumonia patients or those intimately exposed to them. This knowledge should make us regard pneumonia as a contagious disease and should cause us to exercise greater care in guarding against its transmission than has been the custom in the past.

This reviewer believes that the London Lancet has not made any overstatement in its praise of this new edition in saying: "To those who have suffered many things from the usual type of popular lecture, this health talk will come as a happy relief."

THROMBO-ANGIITIS OBLITERANS, by *George E. Brown and Edgar V. Allen*.
W. B. Saunders Co., Philadelphia, 1928

This is one of the Mayo Clinic Monographs, and while it is a small volume of about 200 pages, the subject is thoroughly covered and very well presented. The work of all previous investigators is thoroughly discussed and much new material is added from special work done at the Mayo Clinics.

It shows the advantages of group investigation of a special subject in medicine, where there is an abundance of clinical material. Three hundred cases of thrombo-angiitis obliterans were studied in the Mayo Clinics from 1922 to 1927, inclusive. Fifty amputated specimens were studied pathologically—27 by one of the authors.

A complete clinical and pathologic history of thrombo-angiitis obliterans is given in the first chapter.

The authors have thoroughly investigated the various etiologic factors of this disease. They found thrombo-angiitis to occur, as a rule, between the ages 25 to 50 years, and that occupation was in no way responsible as a causative factor. Cold has a deleterious effect upon some with this disease but is only contributory.

They believe that "tobacco smoking is not the primary etiologic agent, but that there is some evidence to show that it may be a contributing factor."

The authors believe that this disease occurs in individuals of every known nationality, though in the cases at the Mayo Clinic "over 50 per cent were Hebrews, which is many times the percentage of this race registering there." This they conclude indicates a definite predominance of thrombo-angiitis obliterans among Hebrews, particularly those of Polish, Bohemian, Austrian, and Rumanian extraction.

With few exceptions this disease has been noted in males and the authors believe it is infectious in origin and that the prostate gland may account for this predilection for the male.

They state that "only three patients of the entire group were free of demonstrable infection in the tonsils, teeth, and prostate gland. Although a definite statement can not be made regarding the significance of distant foci of infection in the cause of the disease, the evidence is at least suggestive." They further state "In summarizing the results of our own work and that of various other investigations, on the infectious nature of the disease, we would say that while the proof is lacking there is much evidence to indicate that an infectious or bacterial toxic substance is the etiologic factor."

Since the authors believe that thrombo-angiitis obliterans is due to infection they believe that a specific organism will be found. They advocate more intensive bacteriologic study. They are now doing work of the kind at the Mayo Clinic on resected veins which clinically show evidence of acute inflammation.

AN ATLAS OF HUMAN ANATOMY FOR STUDENTS AND PHYSICIANS, VOLUMES I AND II, by *Carl Toldt, M. D.*, assisted by *Alois Dalla Rosa, M. D.*. Adapted to English and American and International Terminology by *M. Eden Paul, M. D. Bruz, M. R. C. S., L. R. C. P.* Second edition. The Macmillan Co., New York, 1928

Not since the atlases of Werner Spalteholz, which were first published in 1904, has anything been seen to compare with this monumental work of Toldt.

In 1,500 plates he has enabled the reader to visualize gross anatomy in a way which will gratify all true students of anatomy. The art of depicting anatomical dissections and spacial relationships has reached its highest point in these volumes. Dissection itself is the only means by which these relationships could be shown with greater perfection. The artist and the anatomist have combined here a life's work in which they have portrayed and conveyed with the most superb excellence precisely what the student of anatomy is seeking—an exact mental image of anatomical structures with their interrelationships.

It is one thing to memorize a paragraph which describes some structure; it is another thing to know what that structure looks like viewed from all angles and in its various dissections.

Sufficient labeling and explanatory footnotes accompany each plate. Also, in Volume II the appendices further amplify the matter, so that this work leaves nothing to be desired, and is altogether a final and complete treatise on human gross anatomy.

THE KAHN TEST, A PRACTICAL GUIDE, by *R. L. Kahn, M. S., Sc. D.* The Williams & Wilkins Co., Baltimore, Md., 1928

It is expected that the book will be received with the same warm welcome with which the profession has received the test.

The Navy has adopted the Kahn test as the standard, not only because of its greater simplicity, but because of its reliability. A. I. Kendall, professor of research bacteriology in the Northwestern University Medical School, considers the development of the Kahn test to be the outstanding recent event in the field of diagnosis. In view of the great value and importance of the test, no medical officer can afford to be without this latest discussion of its technical aspects. The book has been placed on the supply table and is available for the libraries at all places of naval medical activities.

In considering a second edition to Kahn's previous book, *Serum Diagnosis of Syphilis by Precipitation*, it was decided to divide it into three volumes: One dealing with technique, for laboratory workers; one with clinical application, for physicians; and one dealing with fundamental aspects, for special students. In conformity with this plan, the present volume may be looked upon as a second edition of the section on "Procedure" in *Serum Diagnosis of Syphilis by Precipitation*.

The first chapter contains a splendid résumé of the phenomenon of precipitation in syphilis and acquaints the reader with the many absorbing historical and theoretical aspects of the subject. The remainder of the book is a practical guide for conducting the test and gives all the necessary information as to apparatus, materials, reagents, procedures, etc., both for blood serum and spinal fluid.

The final chapter deals with the micro procedures, and the performance of the test with chancre fluid.

PHYSIOTHERAPY, THEORY, AND CLINICAL APPLICATION

By

Harry Eaton Stewart, M. D., Director of New Haven School of Physiotherapy; Attending Specialist in Physiotherapy, United States Veterans' Bureau; Consultant in Physiotherapy, New York, New Haven & Hartford Railroad Co.; Formerly Assistant Director, Section of Physiotherapy, Office of the Surgeon General, United States Army; and Supervisor of Physiotherapy, Bureau of United States Public Health Service. Second edition. Paul B. Hoeber (Inc.), New York, 1929

Those who are not familiar with the uses and technique of the various forms of physiotherapy will find in this book a large store of valuable information which can be readily gleaned from its pages. The first part of the book is devoted to the theoretical aspects of these measures and the second part to their clinical application. It is safe to say that most of us will be surprised to find what a volume of sound theory exists behind these forms of therapy, and equally surprised to learn of their wide range of application.

The author has written of these matters in an exceedingly clear style, and with the help of many excellent illustrations he has managed to present the reader with a good fund of useful information in a manner which makes the reading more a pleasant privilege than a dull task.

Although he has intended to make the book primarily a reference manual, he has presented his proof of the value of many forms of physiotherapy in such a convincing way that he has unwittingly treated his readers to some very agreeable entertainment; and one is apt to put aside the book with all the reluctance and all the satisfaction felt at the end of an educational motion picture of exceptional merit.

The book is highly commended to those who wish to become or are interested in the subject, but particularly is it commended to those who do not wish to become interested, as these latter are certain to be converted by Doctor Stewart, and will, in spite of themselves, become eventually armed with this highly useful branch of therapy.

A TEXTBOOK OF SURGICAL DIAGNOSIS, Volumes I and II. Edited by *A. J. Walton, M. S., F. R. C. S., B. Sc., M. B.* Willlam Wood & Co., New York, 1928

These volumes on surgical diagnosis should be of special interest, as they represent the latest thought on this subject by eminent specialists of Great Britain. They will be of value to the internist as well as the surgeon, as the discussion of each disease or condition is concerned solely with the question of diagnosis and usually the burden of responsibility for calling in a surgeon rests upon the general practitioner or internist.

The term surgical diagnosis implies the necessity for a surgical procedure of some kind. For this reason it is believed that the value of the volumes would be enhanced for the general practitioner or internist if there were a short discussion of the reason for operative interference or the time when a surgeon should be called in consultation, following the description of the symptoms and diagnosis of the disease, injury, or condition. There are several instances where statements in regard to the necessity for operation are given, e. g., in the sections on osteomyelitis, empyema, acute gastric ulcer, and others, and after reading them there was a feeling of satisfaction to know that the condition did or did not need immediate surgical treatment or that surgical treatment should be delayed until a certain period of the disease; also that some other book did not have to be consulted to ascertain these facts.

The chapters are logical in their sequence and each one is written by a specialist in his line. The discussion of each disease, injury, or condition is concise, yet complete enough for all practical purposes.

The illustrations are carefully selected and help to promote understanding of the subject matter. It is interesting to note that the chapter on Acute Infections of the Hand by Kanavel is the only one written by a United States surgeon.

Unlike some of the medical books by American authors published in the United States during the past year, the writers of these volumes use the old bacteriological nomenclature instead of the nomenclature adopted by the Society of American Bacteriologists.

AN INDEX OF DIFFERENTIAL DIAGNOSIS OF MAIN SYMPTOMS, by various writers. Edited by *Herbert French, C. B. E. (Military), M. A., M. D., Oxon., F. R. C. P., London, Physician to His Majesty's Household; Physician and Lecturer, Guy's Hospital; Consulting Physician to Queen Alexandra's Military Hospital, Milbank.* Fourth edition. William Wood & Co., New York, 1928

There are some 20 contributors, all leading medical men of England, to this volume. The greater part of it, that part dealing with symptoms and conditions in the scope of internal medicine, has been written by Herbert French.

This book has often been spoken of as the "Practitioner's Bible" and there is probably no book which better deserves the name. The articles on the various symptoms are arranged alphabetically throughout the book. There is no other book which makes available in such a short time so much information of value and importance on any symptom one would care to investigate. An index of more than 200 pages further facilitates the finding of information sought.

The great demand for this book well indicates the esteem it enjoys among physicians. The supply of the first printing of this edition in September, 1928, was quickly exhausted, necessitating a second printing in November, 1928. The fact that more than 30,000 copies of previous editions have been sold, and that it has been translated both in Italy and Spain, offers further testimony of its usefulness.

Practical utility in diagnosis has been the criterion for inclusion of material in this book.

The preface to the first edition, which appeared in 1912, contains a brief and precise description of the book, which applies equally to this fourth edition:

This book is a treatise on the application of differential diagnosis to all the main signs and symptoms of disease. It aims at being of practical utility to medical men whenever difficulty arises in deciding the precise cause of any particular symptom of which a patient may complain. It covers the whole ground of medicine, surgery, gynecology, ophthalmology, dermatology, and neurology.

ACUTE INFECTIOUS DISEASES, by Jay Frank Schamberg, A. B., M. D., Professor of Dermatology and Syphilology in the Graduate School of Medicine, University of Pennsylvania; formerly Assistant Diagnostician to the Bureau of Health and Assistant Consultant to the Philadelphia Hospital for Contagious Diseases; Member of the Pennsylvania State Vaccination Commission (1912); Ex-President of the American Dermatological Association; Special Consultant to the United States Public Health Service; Dermatologist to the Philadelphia General and Jewish Hospitals; Director of the Research Institute of Cutaneous Medicine; Corresponding Member of the British, French, and Danish Dermatological Societies; Member of the German Dermatological Society; and John A. Kolmer, M. Sc., M. D., Dr. P. H., D. Sc., LL.D., Professor of Pathology and Bacteriology in the Graduate School of Medicine of the University of Pennsylvania; Head of the Department of Pathology in the Research Institute of Cutaneous Medicine; Consulting Pathologist to Misericordia, St. Vincent's, Memorial and Jeannes Hospital; formerly Pathologist to the Philadelphia Hospital for Contagious Diseases and Assistant Bacteriologist to the Bureau of Health, etc. Second edition, thoroughly revised. Illustrated with 161 engravings and 27 full-page plates. Lea & Febiger, Philadelphia, 1928. Price, \$10.

Comparatively few diseases are dealt with in this book, but these are discussed with a thoroughness which is truly exhaustive.

The first five chapters are devoted to the subjects of vaccinia and smallpox. The allotment of so much space to the subject of vaccination "is due," so the authors say, "to the unnecessarily controversial character of this subject. It is a sad commentary upon the intelligence and judicial mindedness of certain elements in the community that it is still necessary to stress the evidence in favor of vaccination."

The chapters on scarlet fever include complete information on the subjects of the Dick test, vaccination, and specific antitoxin treatment of the disease.

There is an interesting short chapter on the "fourth disease" (Filatov-Dukes disease). This disease is "alleged to be a contagious eruptive disease characterized by a scarlatiniform eruption with milder symptoms and an incubation period much longer than that of scarlet fever."

The chapter on diphtheria has been rewritten and new chapters on the prevention of diphtheria, Vincent's angina, serum anaphylaxis, erysipelas, mumps, whooping cough, erythema infectiosum and cerebrospinal meningitis have been added.

DISEASES OF THE EAR, NOSE, AND THROAT, MEDICAL AND SURGICAL, by *Wendell Christopher Phillips, M. D., ex-President American Medical Association; Formerly Professor of Otology, New York Postgraduate School and Hospital; Surgeon to the Manhattan Eye, Ear, and Throat Hospital; Fellow and ex-President of the American Laryngological, Rhinological, and Otolological Society; Fellow of the American Academy of Ophthalmology and Otolaryngology; Member of the New York Otolological Society; Attending Otolologist to the Postgraduate Hospital and Babies' Wards; ex-President of the Medical Society of the State of New York.* Seventh edition. F. A. Davis Co., Philadelphia, 1928. Price, \$9.

In this comprehensive work, the author has successfully brought the subject matter up to date.

He presents a very interesting chapter on The Hearing Problem. This should be of especial interest to the general practitioner. The part having to do with function testing is worthy of note.

The section dealing with diseases of the nasal accessory sinuses is adequate and will appeal to the general man. Perhaps too much space has been given to the operative side and too little to the conservative methods in the treatment of sinus disease.

Section III, devoted to diseases of the larynx is excellent. The subject matter is presented compactly and in a clear manner.

This seventh edition is on the whole an excellent text and reference book for student, general practitioner, and specialist.

PLASTIC SURGERY OF THE ORBIT, by *J. Eastman Sheehan, M. D., F. A. C. S., Professor of Plastic Surgery, New York Postgraduate Medical School, and Hospital Associate Surgeon and Lecturer to the International Clinic of Otorhinolaryngology and Facio-maxillary Surgery, Paris; Member of American Association of Plastic and Oral Surgeons, etc.* The Macmillan Co., New York, 1927. Price, \$12.

The author in presenting this book on plastic surgery of the orbit has added something very useful to the literature of this field. It is an excellent work carefully prepared and made up in three parts: Part I, Anatomy and Physiology; Part II, Preparation, After Care, Skin Grafts, Surgical Conditions; Part III, Operative Procedures.

Doctor Sheehan presents the section on anatomy and physiology in an entertaining though thorough manner. He makes the very definite impression that one doing surgery in this field must have the proper understanding of these subjects. He lays considerable stress on the part the lymphatics play in the postoperative period.

Part II is filled with excellent advice which comes from one who has had a world of experience. The section on postoperative care is worthy of extra attention.

From time to time the author expresses himself on the subject of keloid. He feels until its cause can be found plastic surgery will never gain its real place.

Part III covers operative procedures in an admirable manner. The section dealing with the treatment of dacryocystitis is well presented. The illustrations and photographs are excellent and numerous.

This work is invaluable to the surgeon doing plastic work about the face. It will be a welcome addition to the library of the military surgeon.

BACTERIOLOGY AND SANITARY SCIENCE, by *Louis Gershenfeld, Ph. M., B. Sc., P. D., Professor of Bacteriology and Hygiene in the Philadelphia College of Pharmacy and Science, Philadelphia.* Lea and Febiger, Philadelphia, 1929

This book is written primarily for use by pharmacy students, nurses, chemists, and others in similar pursuits who are expected to have a working knowledge of bacteriology and sanitation. The book accomplishes exactly the purpose for which it was written. Pharmacists especially should find it a distinct help, since the preservation and sale of biological products require a correct understanding of their manufacture and use. Moreover, pharmacists are frequently asked questions by the laity concerning such matters as disinfection, insecticides, and deodorants, and questions regarding sanitation in general. This book supplies in a ready, concise form just the knowledge needed in this connection.

The author has shown a wise choice of subjects for this class of readers, and has most ably measured his descriptions so that emphasis would correspond with the relative importance of the subjects.

The book is the outgrowth of lectures given to students in pharmacy, chemistry, and allied sciences in the Philadelphia College of Pharmacy and Science and it shows well the long experience the author has had and the expertness he has acquired in the art of teaching. He does not burden the student with the numerous modifications of laboratory technique but gives him fundamental principles and the full details of standard methods.

Part I deals with bacteriology; Part II with animal parasitology; Part III with infection, immunity, allergy, and biological products; Part IV with sanitary science.

THE HEART IN MODERN PRACTICE, by *William Duncan Reid, M. D., Assistant Professor of Cardiology, Boston University Medical School.* Second edition. J. B. Lippincott Co., Philadelphia, 1928.

The first edition of this publication appeared in 1923. This, the second edition, is completely revised and enlarged.

This book was written with the idea that the general physician would have a book on heart affections covering the entire subject. The subjects that could be treated in a brief way were so handled, yet the author did not sacrifice clarity for brevity. The new knowledge pertaining to affections of the heart has been inserted.

The book is divided into seven chapters and two appendices covering the modern views of the abnormal heart. There are seven chapters on the arrhythmias, each type being fully explained and well illustrated with electrocardiograms and a few polygrams of the plotted type.

In the appendix the author has a well-prepared diet and occupational therapy table for cardiac patients. There are also 29 case-history reports.

The author has rearranged the chapters in this book to conform to the classification of heart disease as adopted by the American Heart Association.

This is a well-written book containing 466 pages. The functional conditions are well explained. It is an excellent text on the subject.

MEDICAL CLINICS OF NORTH AMERICA, JANUARY, 1929

W. B. Saunders Co., Philadelphia

This number of the Medical Clinics is known as the Philadelphia number.

An important Jefferson Hospital contribution to this number is that from the clinic of Dr. Thomas McCrae. This paper, which concerns the early diagnosis of empyema in lobar pneumonia, stresses the importance of considering empyema as a complication of pneumonia which may be present in the early course, rather than as a sequel to the disease. Careful study of the physical signs and early use of the exploring needle are urged to avoid the need of drainage or the undue delay of drainage.

Dr. P. S. Pelouze has written an article of unusual interest and importance. This deals with the rôle of the prostate in the causation of remote focal infective symptoms. He believes that the prostate is infected in at least 35 per cent of adult males. This includes a surprisingly large number of individuals who have never had gonorrhea.

Other foci of infection, such as teeth and tonsils, are commonly the primary causes of prostatic infection, and it is often not possible to clear up the prostatic pathology until these other foci have been removed. Drainage by means of gentle massage is the best means of producing a cure.

HANDBOOK OF MICROSCOPIC TECHNIQUE

Edited by *C. E. McClung, Ph. D., Professor of Zoology, University of Pennsylvania; Director of Zoological Laboratory, University of Pennsylvania.* Paul R. Hoeber (Inc.), New York, 1929. Price, \$8.

In this volume of 510 pages with 43 illustrations, 24 experts in various fields of microscopical technique have assembled for practical use the latest approved methods for workers in both animal and

plant tissues. The book is divided into two parts. The first part deals in detail with the fundamentals of section and nonsection methods of preparing microscopical slides and should prove very helpful to the inexperienced worker. In the second part special methods used in bacteriology, botany, cytology, embryology, histology, and protozoology are given. Several methods are often described for the same procedure, which makes it a reference book of great value to the experienced worker.

By a system of cross reference all unnecessary repetition of technique by the various contributors has been avoided.

To possess a volume dealing with technique in both plant and animal tissues is not without value because of the similarity of problems arising in research work in the two kingdoms. This volume would be a valuable asset to any laboratory worker, whether student or expert.

THE OPERATIONS OF SURGERY, VOLUME I, by *R. P. Rowlands, O. B. E., M. S., London, F. R. C. S., England, and Philip Turner, B. Sc., M. S., London, F. R. C. S., England.* Seventh edition. The Macmillan Co., New York, 1927.

In the preface the authors pay a high tribute to the first author of this work, the late W. H. A. Jacobson, of England, who devoted many years of his life to the original and succeeding editions. The main objects of the book, as set forth in the preface, are:

1. To give such a comprehensive and detailed account of the operations of surgery as to be of real assistance to young surgeons taking up responsible positions and to candidates for the higher examinations.

2. To provide a convenient source of reference to the busy surgeon, who sometimes finds it difficult to keep pace with the rapid changes and progress of surgery.

3. To give credit and fair criticism to any new work that seems worthy of consideration and trial.

Volume I of this work, which contains 1,020 pages with 900 illustrations (43 in color), covers the surgery of the upper extremity, the head and neck, the thorax, the lower extremity, and the vertebral column. The book has been very ably indexed.

The authors deserve credit for the manner in which they have covered the field of general surgery taken up in this volume. In the special branches, such as surgery of the nervous system, nose and throat, orthopedics, etc., only the most important and well-established operations which a general surgeon is likely to perform are described.

Very little space has been allotted to regional or local anesthesia, which is becoming popular in America. The succeeding volume may cover this important subject more in detail.

As a convenient reference book in general surgery this work accomplishes a distinct purpose and as such is an asset to the library of general surgeons.

DIABETIC SURGERY, by *Leland S. McKittrick, M. D., F. A. C. S., Visiting Surgeon, Palmer Memorial Hospital; Assistant Surgeon, New England Deaconess Hospital; Surgeon to Out-patients, Massachusetts General Hospital; and Howard F. Root, M. D., Assistant Physician, New England Deaconess Hospital; Associate in Medicine, Peter Bent Brigham Hospital and Palmer Memorial Hospital*, with a foreword by *Daniel F. Jones, M. D., and Elliott P. Joslin, M. D.* Lea & Febiger, Philadelphia, 1928.

That diabetics requiring surgical treatment present to the surgeon problems calling for special consideration is a truism. This book is largely concerned with the new responsibility that insulin has placed upon the surgeon, and the authors have made the book to a great extent a review of their experiences in the work with these cases at the New England Deaconess Hospital during the first five years of the "Banting Era."

Doctor Joslin, in his foreword, says: "The surgical diabetic has been the serious diabetic, the diabetic who died. This is still true and to an extent ever must be, because the surgical diabetic is the one with the most complications. Yet insulin and concurrent surgical and medical effort have won unlooked-for victories."

The authors discuss the incidence of surgical conditions among diabetics and the surgical risks involved, making use of some elaborate and carefully prepared tables of statistics.

The question of anesthesia and choice of anesthetic is discussed in detail. Spinal anesthesia is highly recommended in operations where its use is possible.

Two chapters are given to the subject of diabetic gangrene and allied lesions, with methods of estimating the efficiency of the blood supply, measures for preventing gangrene, and the surgical treatment when gangrene appears.

A chapter of great interest is that concerning carbuncles and infections of the skin.

NELSON LOOSE-LEAF SURGERY, Prepared under the direction of an advisory board comprising the leading surgeons in the profession. Editor in chief, *Allen O. Whipple, M. D., Professor of Surgery, College of Physicians and Surgeons, Columbia University; Director of Surgical Service, Presbyterian Hospital, New York City.* Associated editor, *Fordyce B. St. John, M. D., Professor of Surgery, College of Physicians and Surgeons, Columbia University, New York City.* Volume VII. Thomas Nelson & Sons, New York, 1928.

The first four volumes of this set were reviewed in the July, 1928, number, and Volumes V and VI in the October, 1928, number of the BULLETIN.

Volume VII is devoted to gynecology and surgical obstetrics. As in the other volumes, the contributors are men of outstanding prominence in their profession.

The chapters on gonorrheal diseases of the female genitalia and on puerperal infection are terse, easily and quickly read, and embrace many of the newer concepts of the pathology and treatment of these conditions. The chapter on syphilis in women, by George Gellhorn, is a veritable monograph and is amply and beautifully illustrated.

Another chapter which seems to be presented in an exceptionally able manner is that on sterility in the female, by W. H. Carey.

Medical officers whose duties include the practice of gynecology and obstetrics will find this addition to the Nelson Loose-Leaf set one of great value and convenience in their work.

RÖNTGENOLOGY, by *Alban Köhler, M. D., Former President of The German Röntgen Society, etc.* Translated into English from Fifth German edition by *Arthur Turnbull, M. A., B. Sc., M. B., Ch. B.* William Wood & Co., New York, 1928. Price, \$14.

This most valuable and comprehensive work, by one of the world's foremost Röntgenologists, has at last been made available to English-speaking röntgenologists, through the fine translation by Doctor Turnbull. To those reading German the book has long been a standard reference work for the busy radiologist and textbook for the student of radiology. Four previous editions have been limited to the German text; even so, Doctor Köhler's book has been awarded a preeminent place in the Röntgen literature of Europe and America.

Doctor Köhler states the object of the book to be: "An adviser on those findings which exhibit or appear to exhibit slight and not particular divergencies from the normal anatomical picture." It is in this field of radiology that the busy radiologist and student alike have their greatest difficulty. The common types of the normal in radiology are usually not difficult to recognize, and the evident pathological conditions need little training and experience to be easily identified; the difficulty lies in the differentiation of atypical variations of the normal and border-line pathological change. It is with these more difficult interpretations that Doctor Köhler's book will prove of invaluable help.

To the student and worker in the field of radiology the work of Doctor Köhler serves in the same indispensable way as a standard textbook of anatomy for the student of surgery. The book is most heartily commended to all members of the medical profession, and especially to the specialist in Röntgen diagnosis, since Röntgen diagnosis is so intimately interwoven with the practice of modern medicine.

SURGICAL DIAGNOSIS IN TABULAR OUTLINE, by *Dr. A. J. Cemach, Vienna, Austria*. Authorized translation, with additions and notes by *Edward L. Bortz, M. D., Associate in Medicine, The Lankenau Hospital, Philadelphia, Pa., Assistant Instructor in Pathology, Medical School, University of Pennsylvania*. F. A. Davis Co., Philadelphia, 1928. Price, \$12.

As stated by Dr. John B. Deaver in an introductory note, this is not a textbook but a desk reference book. As such it is an extremely useful volume. Evidently it is considered so in Europe, where it has reached its fourth edition. This translation by Doctor Bortz makes it available for the non-German-reading American physician.

Diagnostic criteria for the whole range of the more common surgical conditions are arranged in tabular form, yet not so briefly as to be valueless. Sufficient is given to enable the physician with an average knowledge of surgery quickly to reach a decision as to which one of several similar conditions is probably present.

The tables of skull and brain injuries and of fractures and dislocations are especially valuable.

The book is profusely illustrated, there being 129 plates containing 548 separate illustrations.

INTERNATIONAL CLINICS, VOLUME IV. THIRTY-EIGHTH SERIES. Edited by *Henry W. Cattell, M. D.*, with collaboration of *Charles H. Mayo and others*. J. B. Lippincott Co., Philadelphia, 1928

The usual high standard of articles which appear in *International Clinics* is maintained in this volume.

A wide range of subjects is covered and, since every article is by an authority on the particular subject with which it deals, everything in the book is quite worth reading.

Several articles are devoted to the subjects of aging and old age. These papers were read in the Graduate Fortnight of the New York Academy of Medicine in October, 1928. One of particular value in this series is a discussion of Digestive Problems in Old Age by Thomas R. Brown, of the Gastrointestinal Clinic, Johns Hopkins Hospital.

The latter section of the book is called "Medical Questionnaires." This will appeal strongly to the busy physician in search of a concise digest of recent literature dealing with topics which occupy prominent places in present-day medical discussion.

"What is the present conception of colds?" is the first of these questions to be answered. The references used for the reply are all from foreign sources, mostly German. Another reply of considerable interest at present is that to the question "How far have d'Herelle's bacteriophage theories been applied to therapy?"

MEDICAL CLINICS OF NORTH AMERICA, NOVEMBER, 1928. W. B. Saunders Co., Philadelphia

This number of the well-known Medical Clinics is made up of papers from staff members of various New York hospitals, and is known as the New York number.

As usual, there is a wide variety of subjects. Among the topics dealt with in this number, are those of nephritis, tuberculosis in childhood, hypothyroidism, obesity, chronic arthritis, and hematologic diseases.

Of particular interest is a paper on Chest Pains, from the clinic of Drs. Connie M. Guion and the late Frank S. Meara.

Chest pains from many different causes are classified and discussed largely from the standpoint of the mechanism entering into their production. The matter of treatment of these pains is gone into at considerable length and detail.

THE SURGICAL CLINICS OF NORTH AMERICA, DECEMBER, 1928. Volume 8, No. 6. W. B. Saunders Co., Philadelphia

This is the Pacific Coast Surgical Association number and is dedicated to the memory of John Hunter on the bicentenary of his birth.

Dr. E. L. Gilcreest, of the University of California Hospital, has contributed a paper of special historical interest called John Hunter, the Founder of Scientific Surgery.

Other papers discuss many problems of surgical practice.

INDEX TO OSLER AND MCCRAE'S MODERN MEDICINE. Lea and Febiger, Philadelphia, 1928. Price, \$1

This is an index to the third edition of the 6-volume set of Osler and McCrae. Those having this set will, of course, find this little index volume a great convenience. All volumes of the set have been reviewed in recent numbers of the BULLETIN.

MODERN X-RAY TECHNIC, by *E. C. Jerman.* Bruce Publishing Co., Minneapolis, Minn. Price, \$5.50

The author states this book is the result of many years' teaching X-ray technique. This appears to be borne out by the text and manner of presenting the material therein. The contents are limited to X-ray technique and the proper use of accessory apparatus. Elementary X-ray and electrical physics, and the construction of X-ray machines and accessory apparatus are not discussed as fully as one might desire. The book is written in a manner which makes it of considerable value to the X-ray technician who would develop a standardized technique, based on modern Röntgen diagnostic requirements. The various factors entering into the production of high-

quality radiographs are discussed at length, and the effect each has on the quality of the radiograph.

Unfortunately, the author has not been free of bias of opinion in the description of the various essential pieces of apparatus. He frankly admits he is partial to Victor equipment, and his technique charts are based thereon. With this limitation in mind, the book is recommended to the painstaking, careful technician as an operating manual based on that hard earned, invaluable factor—experience.

PARTNERSHIPS, COMBINATIONS AND ANTAGONISMS IN DISEASE by *Edward C. B. Ibotson, M. D., B. S., F. R. S. M., London.* F. A. Davis Co., Philadelphia, 1928

This little book could quite possibly furnish some entertainment to the laity. Most medical men would very likely be bored by it unless they are in a mood for some light reading.

By "partnerships" the author means two coexisting diseases, each of which in attacking and weakening the host, renders more favorable the conditions for the survival of the other. He gives as examples of such partnerships, diphtheria, and streptococcus infections; malaria and dysentery; diabetes and tuberculosis; gout and rheumatism.

Antagonisms are less common. As examples of these he mentions that the bacillus of anthrax will not grow in culture with the bacillus pyocyaneus, and that syphilitic negroes in malarial districts do not develop cerebral syphilis. He has not taken into account the facts that we are not at all certain whether malaria per se is the curative factor in cases of paresis receiving malarial inoculations, nor that syphilitic natives of nonmalarial tropical countries (Guam, for example) do not develop cerebral syphilis.

A chapter entitled "Is Disease Hereditary?" should be enjoyed by the laity who like medical subjects, and altogether it is not bad reading.

In the opinion of this reviewer, the best feature of the book is that it contains many excellent photographs of distinguished physicians, such as Metchnikoff, Osler, Bright, Gull, Brown-Séquard, Pierre Marie, and Thomas Addison.

TEXTBOOK OF CLINICAL NEUROLOGY, by *M. Neustaedter, M. D., Ph. D., Visiting Neurologist, Central Neurological Hospital, Welfare Island; Clinical Professor in Neurology, New York Polyclinic Medical School and Hospital; Attending Neurologist, Bellevue Hospital, Outpatient Department, Stuyvesant Polyclinic, St. Mark's Hospital; Neurologist, Kings County and City Hospital, Welfare Island, New York.* F. A. Davis Company, Philadelphia, 1929. Price, \$6.

The author has followed a very distinct departure from the conventional pattern of neurological textbooks. The departure here is

in such a direction as to greatly increase the merit of the book and to make it unusually welcome even at a time when medical students and practioners are already confused by the large array of new medical texts offered them.

The older works on neurology were without exception dull, voluminous, and cumbersome, and made laborious reading. This book is actually new and different; it contains much that is original, and includes the many recent worth while contributions to clinical neurology.

The author has remained true to the title, and has kept the strictly clinical aspects of the subjects always in the foreground.

The student and practioner in examining a patient want to translate the history and findings into terms of pathology. To do this at all conveniently they should have a book whose chapter divisions are based on symptom-complexes, with a listing and discussion of the lesions which could produce these symptoms.

The author has here supplied such a book, and his attempt to shape it on this plan has been a serious and a very successful one.

His aim throughout the book has been, so he tells us in the preface, "to be brief and lucid, yet to incorporate all the material facts without befogging the issue or doing violence to the subject." He has never wavered in this aim (except intentionally in his discussions of poliomyelitis and epidemic encephalitis) and has hit his mark with laudable precision and consistency.

In the chapter on the Method of Neurological Examination he covers a large subject with remarkable clarity and brevity and manages to teach a great deal of neurology in a manner that will delight the student. Here the reader becomes acquainted with the author's tremograms and their interpretation. This is a rather new and novel contribution.

The chapter on spinal fluid examination includes besides a thorough treatise on the examination of the fluid, all the technical points concerned in the puncture, and an account of the diagnostic aid given by lipiodol injections.

The section on encephalitis contains much that is original and includes the serological differentiation between epidemic encephalitis and poliomyelitis. This discussion of serology in these diseases is based largely on the work done by the author in 1921 in collaboration with Doctors Banzhaf, Larkin, and Hala.

The book is profusely illustrated with diagrams, well-selected photographs of patients, radiographs, microphotographs of tissues, and photographs of gross tissues and their sections.

NEUROSURGERY, PRINCIPLES, DIAGNOSIS AND TREATMENT, by *William Sharpe, M. D.*, Professor of Neurosurgery, New York Polyclinic Hospital and Post Graduate Medical School; Attending Neurosurgeon; Hospital for the Ruptured and Crippled, Beth Israel Hospital, etc., and *Norman Sharpe, M. D.*, Attending Neurosurgeon; St. Mark's Hospital; Hospital for the Ruptured and Crippled. J. B. Lippincott Co., Philadelphia, 1928.

In this textbook on neurosurgery the author has brought into a single volume an outline of the recent work of many neurosurgeons. The volume is unique in that for the first time the subject is compressed into a single book.

A study of the excellent bibliography shows from what diverse sources the facts set down are drawn.

The neuromechanical aids to diagnosis are here assembled. Ventricular röntgenograms as described by Dandy; cisterna puncture, the newer methods of spinal puncture, described by Ayer; the Queckenstedt test of bilateral jugular compression; the use of lipiodol in the administration of spinal block, are herein described in correlation to their clinical field of application.

The general surgeon should find the chapters on brain and spinal cord injuries of special interest because the author here undertakes to state his own views of the indications for operative interference.

To the general surgeon called upon to meet surgical emergencies in this field, the book should prove a stimulant. The general practitioner who reads the book will think in terms of this subdivision of surgical practice. The younger surgeon may be awakened by the optimistic picture drawn of final results in the general field of neurosurgery as in contrast with the less hopeful picture of the final results in the surgery of brain tumors.

SPINAL ANESTHESIA, by *Charles H. Evans, M. D.*, Clinical Assistant, New York Post-graduate Medical School and Hospital, Lying-in-Hospital of the City of New York; Assistant Surgeon, New Jersey Orthopedic Hospital, Orange. Paul B. Hoeber (Inc.), New York, 1929. Price, \$5.50.

This is an excellent monograph covering completely in detail spinal anesthesia. The book is very well arranged and has a generous supply of illustrations and diagrams.

Spinal anesthesia is out of the experimental stage, and in the hands of skilled operators has become not only the least dangerous, but the anesthesia of choice for many operations, especially those in the lower abdominal quadrants, genital organs, perineum, rectum, and upon the lower extremities.

The author stresses the fact that success in spinal anesthesia depends upon the anesthetist rather than the drug or technique of

injection. Danger is increased from practically nil to a very real quantity by neglect of the available safeguards and antidotes. Failures should be attributed to incorrect technique alone. Postoperative headaches and other untoward effects are dependent upon either the "sins of commission" or "sins of omission."

The author concludes that "mastery of spinal anesthesia will place in the surgeon's hands the safest, the quickest, and the most satisfactory anesthesia known to-day for use in a great number of different conditions."

REPORT OF THE INTERNATIONAL CONFERENCE ON CANCER, LONDON, JULY 17-20, 1928. William Wood & Co., New York, 1928.

This is the report of the International Conference on Cancer held in London in July, 1928, under the auspices of the British Empire Cancer Campaign. The book of 600 pages is made up of the various papers read before the conference by delegates from all over the world who are interested in some phase of cancer research and treatment.

The papers are grouped under the general headings (1) Etiology of cancer; (2) The relative values of surgery and radiation in the treatment of cancer, (*a*) Statistical evolution of results; (3) Methods of treatment by chemotherapy, with special reference to lead; (4) Pathology, occupational cancer; (5) Surgery, (*a*) The early recognition and treatment of cancer of the stomach, (*b*) Sarcoma of bone; (6) Medicine, (*a*) A consideration of cancer cachexia, (*b*) Cancer of the lung; (7) Diagnosis, (*a*) Diagnostic methods in relation to cancer; (8) Radiology, (*a*) The effects of radium and X rays in the blood vascular and lymphatic systems, with special reference to malignant growths, (*b*) The biological effects of radium and X rays with special reference to the factors of wave length, intensity of radiation, and duration of exposure; (9) Statistics and public health, (*a*) The geographical and racial prevalence of cancer, (*b*) Public action in regard to cancer.

A TEXTBOOK OF MEDICINE by various authors. Edited by *J. J. Conybeare, M. C., M. D., OX. ON., F. R. C. P., Assistant Physician to Guy's Hospital.* William Wood & Co., New York. Price, \$8.

The editor begins his preface with an apology for adding another textbook of medicine to the already large number of such books now available.

His aim, he states, has been to produce a book at the lowest possible cost which would embrace the essentials of medicine without being too synoptic. The volume contains 976 pages. The subject matter

is arranged in 15 sections written by the editor and nine other contributors.

The section on cardio-vascular diseases is particularly valuable. It gives in a clear and concise manner the current English viewpoint in regard to this class of diseases. In addition to the conventional grouping of diseases usually found in books of this type there are sections on diseases of the skin and diseases of infants.

The book impresses the reviewer as one of the best single volume textbooks of medicine which has appeared. It is believed that it will make a strong appeal to students and busy practitioners.

THE DIVISION OF PREVENTIVE MEDICINE

Commander M. A. STUART, Medical Corps, United States Navy, in charge

NOTES ON PREVENTIVE MEDICINE FOR MEDICAL OFFICERS, UNITED STATES NAVY

TUBERCULOSIS

By M. A. STUART, Commander, Medical Corps, United States Navy

Where, when, and under what circumstances tuberculosis had its origin is not known, but we do know that phthisis has existed almost as long at least as recorded history. The word phthisis in its strictly grammatical conception means corruption, consumption, or wasting away, an expression applied to things other than the disease we now call tuberculosis; yet this definition presided in a general way over the idea that the ancient physicians formed in regard to pulmonary phthisis.

Nolan (1928) states that in the earliest medical writings, dating from before the Christian era, there is a great deal recorded concerning the consumptive, the wasted man, the cougher, the blood spitter, and even in that period the ancients knew and recorded that phthisis was not to be found among savage people, but that it was a disease of those who lived in close relationship as for instance, living in houses or exchanging commodities among one another, or in other words, those who had come to live in communities. Community life brought together peoples or tribes so that they could not help noticing that tuberculosis showed a tendency to reappear in certain families generation after generation.

According to Opie (1924) there is no reason to doubt that tuberculosis was widely distributed among civilized peoples who in ancient times inhabited the shores of the Mediterranean. Tuberculosis of the spine has been demonstrated by Smith and Ruffer in Egyptian mummies whose age has been estimated at 3,000 years, and Peterson states that pulmonary tuberculosis was well known to Hindoo physicians long before the beginning of the Christian era.

The Greek and Roman writers furnish evidence that tuberculosis was one of the commonest diseases among these ancient peoples and their conquests doubtless transmitted it to many widely distributed races.

The first clear clinical description of the disease was given by Hippocrates who was born about 460 B. C. He believed that the expectoration of pus succeeding hemoptysis is bad and described phthisis as consisting of a suppuration of the lungs resulting from mucus, blood, or other morbid material in the lung or pleural cavity which failed to be absorbed and was changed into purulent matter. In describing the course of the disease he wrote: "With many persons it commenced during the winter and of these some were confined to bed and others bore up on foot; the most of these died early in the spring who were confined to bed; of the others the cough left not a single person." He also stated that phthisis most commonly occurs between the ages of 18 and 35, and recommended tar in the treatment which is suggestive of the modern use of creosote.

In the first century of the Christian era Cappadox, a Greek physician, described phthisis as a definite pathological process and believed that it was caused by abscess of the lung, chronic bronchitis, or hemorrhage, from which pus might be formed. Considerable knowledge of the disease would seem to be expressed in his recommendation of sea voyages and the use of milk and eggs in treatment. Areteus referred to the narrow chest and the shape of the scapulae by the term *scapulae alatae* and to long thin fingers with swelling of the joints and crooked nails.

Galen (130 A. D.) looked upon tuberculosis as an ulceration or suppuration of lung tissue, the destroyed portion of which was discarded in the expectoration. Among the measures that would tend to dry up secretions and which had been found successful in the treatment of ulcers of other parts he advised his patients to seek dry, elevated resorts and proposed a full milk diet.

No further progress in the study of tuberculosis was made for many years. At the time of the discovery of America by Columbus the disease was regarded as a protracted, wasting, incurable, hereditary affliction which occurred chiefly among adults, but there was no knowledge regarding the cause of the malady or the pathological changes which were productive of the condition.

The Renaissance, or revival of interest in study and invention, which began in Italy in the fourteenth century and gradually spread to other countries, included the beginnings of the science of medicine. Dissections and post-mortem examinations of the human body, at first vigorously proscribed by law and sentiment, became more numerous. Anatomists learned to know the constitution of the human body in detail and to observe the pathological changes resulting from disease. It was noticed that small gray or yellow, hard or cheeselike structures were invariably found in the lungs or other organs of persons who died of phthisis and these structures were

called tubercles. Sylvius, in 1614, is said to be the first to describe tubercle of the lungs. He attributed ulceration in the lungs as due to the softening or suppuration of tubercles, but Morton (1689) was the first to maintain that the tubercle was a necessary antecedent of ulceration and among the first who recognized the great prevalence of tuberculosis. Morton wrote as follows: "Yes; when I consider with myself how often in one year there is cause enough ministered from producing these swellings, even to those who are wont to observe the strictest rules of living, I can not sufficiently admire that any one, at least after he comes to the flower of youth, can die without a touch of consumption"; a truly modern conception of the general prevalence of infection.

Apparently many races, however, entirely escaped tuberculous infection. According to Opie (1924), the studies of Hrdlicka made upon bones removed in immense numbers from burying grounds upon the western slope of the Andes, show that the pre-Columbian Indians were not affected with tuberculosis. The interior of equatorial Africa, the interior of Australia, and the islands of the Pacific were free from tuberculosis when the white man forced his way into them.

The contagion of phthisis or development of the disease following contact with preexisting cases was always feared in Spain, Italy, and in the south of France, and most of the ancient physicians refer to it. Galen, according to Sennert, stated that living with phthisical patients is unhealthy; "the miasms which they emit may enter the lungs of healthy subjects and predispose them to phthisical ulceration"; Van Swieten, that the expectoration of these patients may have a baneful effect on others on account of the offensive odor; and Morton, that if two persons occupy the same bed, one may contract phthisis from the other like any malignant fever. It is said that Valsalva and Morgagni prudently avoided autopsies on the bodies of persons who died from phthisis on account of the recognized dangers of contact with such cadavers.

At the beginning of the nineteenth century evidence had accumulated to such an extent from numerous post-mortem examinations upon the human body that it was generally conceded that consumption was caused by the growth and development of the tubercle. Physical examination as practiced at the present time was almost totally unknown, and it was not ordinarily possible to differentiate consumption from other diseases during life.

Bayle (1803) wrote an original description of the coarse characters of tubercle, and its identity with the pulmonary, granular, and other varieties of tuberculosis which he expounded in his *Recherches sur la phthisie pulmonaire* (1810) and which formed the basis of Laennec's and of subsequent work.

In 1816, Laennec, a native of Brittany and a pupil of Bayle, not being satisfied with his examination of a patient's chest by the simple expedient of placing his ear directly against the chest wall as was then the custom, rolled some paper into the form of a cylinder. He then placed one end against the chest wall while he listened at the other and thus invented the stethoscope. This discovery was announced in 1819 in the first edition of his *Traite de l'auscultation mediate* which is the foundation of modern knowledge of diseases of the chest and their diagnosis by mediate exploration. He showed physicians how to recognize consumption by examination of the chest, and maintained that consumption, phthisis, and tubercle were the same, and that the anatomical unit of consumption was the tubercle. He held that new tubercles could arise from older ones, even at a distance, and could develop into structures that were so different from their original form that their tuberculous nature became unrecognizable. He was also the first to discover and describe the "anatomical tubercle" or post-mortem wart, which was later proved to be identical with lupus verrucosus. Unfortunately he was himself an early victim of phthisis.

Virchow and his coworkers denied the unity of tuberculous lesions and held that the pathological lesions of pneumonia, catarrh, and the common cold might gradually change into the small characteristic tubercle from which the cheesy deposits and cavities developed. Villemin, a French army surgeon, announced in 1865 that he had inoculated rabbits with matter and sputum from tuberculous individuals and that tubercle of the lung had developed in every animal. These results confirmed the infectiousness of tuberculosis, a belief which had long been held by some, but Villemin's findings were not generally accepted as indicated by the following, written four years later: "For the great majority of physicians, tuberculosis is nothing else than the most widespread and for this reason and because of its incurability the most dreaded of all diseases. It is the terror of the public and the cross of the physician, a disease that we must accept as an essential product of our social conditions."

Conheim (1877) injected tuberculous material into the anterior chamber of the eye of the rabbit and by the gradual development of the specific tubercle demonstrated the inoculability of tuberculosis and confirmed the results of Villemin's experiments.

In 1882, Robert Koch announced that he had discovered the causative agent of tuberculosis by special culture and staining methods, that he had grown the virus apart from animal tissue outside the body, and that he had produced tuberculosis with the microorganism which he named the tubercle bacillus.

Tuberculosis means any pathological formation induced in the animal body by the presence of the specific microorganism or any

functional disturbance that results from this anatomic change or from the activities of the tubercle bacilli. Bayle, a century ago in his diagnosis of *phthisie commencante*, dated the onset of the disease from the appearance of "cough, general malaise, and febrile epidoses," but when he recognized pulmonary tuberculous foci in the cadavers of subjects who had not reached the state of incipient symptomatology he designated these *phthisie occulte* and stated that subjects with occult phthisis had no symptoms which would cause one to suspect active phthisis. His records indicate that his patients, though they appeared well nourished and vigorous, had symptoms enough such as repeated colds, amenorrhea, cough, fever, etc., and it may be assumed that some of the patients exhibiting Bayle's "germ of phthisis" really died of miliary tuberculosis.

According to Krause (1928), the trouble was that Bayle had too sharp and rigid an idea of how a patient must "shape up" clinically in order to be regarded as phthisical. "Like all older physicians it was difficult—yes, impossible—for him to think of phthisis without its falling off in flesh and vigor. Notwithstanding our long strides in the century since Bayle we are now and again impressed with the traces of the old point of view that remain to-day—to the great detriment of good diagnosis in tuberculosis; only now attention is centered on the body temperature. And, just as we so frequently read of patients under treatment having their classification changed to quiescent, or arrested, or inactive, upon the return of temperature to normal, and ostensibly on this basis alone, so we find numbers of physicians apparently unable to comprehend tuberculosis as active unless and until the temperature is elevated. It will mark a great advance in diagnosis when the generality of medical men give up the idea that elevation of temperature is the chief and most significant symptom of pulmonary tuberculosis or the *sine qua non* of activity."

The importance of increased fatigability, loss of tone, and disinclination to face accustomed tasks in the recognition of incipient tuberculosis is stressed by Krause, who writes, "We have all listened to the story of the patient—as bit by bit it has come out in the history—how his life long he has shunned vigorous exercise or not over-arduous work, because he never felt good after performing it. Or how little by little he has sought lighter occupation and less exacting responsibilities for the same reason. It is remarkable how these men and women, whose slowly evolving tuberculosis takes years to send them to the physician, gradually, unconsciously, and almost imperceptibly to themselves, adjust with measurable success their duties to their waning capabilities and make a passable accommodation between their tasks and their tuberculosis, which is thus kept just barely below the clinical horizon. Actually it is at the threshold, and at

times across. But the patient is never sufficiently aware of the unwelcome guest. He makes another concession, one more reduction of effort somewhere, achieves tolerable comfort once more, and goes along anew, but at slackened pace. Now and then all this comes out in the history with almost diagnostic circumstantiality."

ROUTES OF INFECTION

Whatever habits, environmental influences, and hereditary effects may be involved, every case of infectious disease represents a biological reaction between invading microorganisms and the host. We have on one hand to deal with all conditions and circumstances that may affect the microorganism, and, on the other hand, those that affect the resistance or susceptibility of the host. The channels through which infection may enter the body are usually grouped under three headings: The respiratory tract, the digestive tract, and through the skin. Rosenau estimates that perhaps 90 per cent of all infections are taken into the body through the mouth which they reach in water, food, and dust, by the fingers, or upon the innumerable objects that are sometimes placed therein. When microorganisms reach the portal of entry to the body three results are possible: (*a*) Immediate destruction or elimination, (*b*) effective lodgment without invasion of the tissues, or (*c*) infection. The latter may be regarded as the successful invasion and growth of microorganisms in the tissues of the body, or, in other words, that they have passed the normal barriers and have invaded and proliferated in the deeper tissues. Virulence refers to the disease-producing power of a microorganism and is dependent upon (*a*) toxicity, or the power to poison the tissues by poisonous products, or poisonous substances resulting from the lysis of bacteria, and (*b*) invasive power, aggressiveness, or adaptation to growth in the human organism and tissue fluids.

Rosenau states that some microorganisms, like the tubercle bacilli and the spirochetes of syphilis, have a very slow, gradual, but progressive power of invasion owing to the lack of acute physiological reaction on the part of the host, resulting from their presence. It follows, therefore, that tubercle bacilli, if they are to produce any pathological effect, must penetrate the epithelial coverings and lodge within the tissues of the body. Whether they are introduced through the epithelium of the skin or mucous membranes of the digestive or respiratory tract is immaterial, for once past these epithelial barriers they are in a favorable environment to produce a lesion. According to Krause (1916), whose work has been extensively drawn upon in the preparation of this article, there is no avenue of predilection for the tubercle bacillus. It needs only to be introduced into the tissues to produce the reaction characteristic to it, while the place

and manner of introduction are material only as concerns the distribution of bacilli and subsequent events that are contingent upon variations of distribution. Intravenous inoculation, unless intentional, is of such rare occurrence that it may be disregarded. It follows, therefore, that the bacilli must pass through epithelium before they can exert their pathogenic action upon the tissues or enter the lymphatic system.

In every case they pass through the epithelium without leaving the slightest trace of tubercle formation at the exact point in the epithelium where they entered. Once through the epithelium they lie in the tissue spaces between the body cells, where they may or may not multiply. If they are not readily destroyed by the protective forces of the body they either form a depot of infection immediately subjacent to the portal of entry or are transported further into the interior of the body.

DEPOT OF INFECTION IMMEDIATELY SUBJACENT TO THE PORTAL OF ENTRY

If this takes place, a lesion will develop. The size of this lesion may vary, depending upon the number of bacilli originally introduced, the degree of multiplication, and the length of time in which they persist, from one so slight that it may escape detection, to one that may be visible to the unaided eye. It may develop progressively, attain considerable size, and finally involve and break through the surface. At any stage in its development it is possible that the process may become arrested. This arrest may be of short duration, after which the process may resume its course of increase in volume and extent, or it may become anatomically fixed and permanent and persist throughout the life of an individual without any great change in the structure of the lesion.

FURTHER TRANSPORTATION OF BACILLI INTO THE INTERIOR OF THE BODY

This may happen with or without localization in the tissues immediately surrounding the portal of entry. If the number of infecting bacilli is very small, all may localize in this area at first, and centripetal extension may take place from this original nucleus of infection after the bacilli have undergone multiplication. It also apparently happens when very small numbers of bacilli are inoculated, that visible lesions may first become manifest at a point comparatively remote from the portal of entry. The tissues at the point of inoculation remain to all appearances normal, while a tributary lymph node first shows tuberculous reaction.

This condition, however, may be more apparent than real, as Krause believes that a careful histological study would indicate that some

reaction, however slight, always results where tubercle bacilli are introduced, although many of these slight superficial lesions may never exceed microscopic size, and, being overcome and transitory, they escape notice, while the more remote focus or foci develop further. Experimental findings show, if the dosage is of any appreciable size, that all of the bacilli are not held or that all of them do not become fixed at the point of entrance, even for a very short period of time. In the course of a few hours after inoculation it can be proved that they are present in tissues some distance away. Although some may remain at the site of inoculation, many undoubtedly begin their progress toward the interior of the body.

After they have penetrated the superficial coverings of the body, the skin and the mucous membranes of the respiratory or the digestive tracts, there is, according to Krause, only one path by which the bacilli can proceed. If they do not remain at the point of entrance and if they are to go farther, they must under natural conditions be carried by way of the lymphatic system. Immediately beneath the skin, or mucous membrane they lie in the tissue spaces, and as tubercle bacilli are nonmotile and can not propel themselves, those that are to move away must be transported. They are therefore picked up or ingested by wandering cells, by polymorphonuclear leukocytes, mononuclear leukocytes, and perhaps by other cells of various types and carried by these into the lymphatic vessels in which their course must always be centripetal so long as they are moving, for under normal conditions a reverse or centrifugal lymph circulation has not been established. If the lymphatic channels are open and the circulation is competent, the bacilli are kept moving toward the interior of the body as long as they are in the lymphatic vessels. At numerous points in the lymphatic system lymph nodes are interspersed, and these increase in complexity from the periphery. As is well known, one function of the lymph nodes is to filter out foreign particles from the afferent lymph, and tubercle bacilli like other foreign particles are held either wholly or in part in the nodes.

Every lymph-node is a converging center for all foreign particles that enter the area drained by the system of lymphatics peripheral to it, and accumulates more foreign particles than any point in its field of drainage. In the same manner infection tends to concentrate in these nodes, simply because they receive more bacilli than reach other points in the area peripheral to them. It may be readily conceived, therefore, why the lymph-nodes are likely to exhibit either the only or the most advanced evidences of the tuberculous infection, if the term "advanced" be considered as expressing size and character of the lesion, unless or until a lesion develops to a considerable size and extent in other tissues where tubercle bacilli may focalize.

As long as lymphatic channels are open or unobstructed, conditions always obtain that permit the conveyance of tubercle bacilli to regionary nodes from any focus from which bacilli may have escaped. This prominence of lymphatic nodes in the progression of tuberculous infection has long been known. It occasioned the so-called Ribbert-Cornet law of localization, which postulates that the portal of entry of tubercle bacilli is always evidenced by the presence of lesions in the lymph-nodes that are tributary to it, or in other words, that the bacilli never enter the body without leaving some trace in the nodes that drain the portal of entry. This assumes that lesions will be unmistakably older in the nodes that are first infected or in those that are so situated anatomically that they lie first in the path of the original infection. In observing the relatively brief and uninterrupted progressive course of the disease in guinea pigs this succession of events is usually found, but experiments that involve more prolonged infection, an infection that may extend over years, together with clinical experience, indicates that infection, once it has reached several widely separated places in the body, need not leave so simple a trail.

Starting from a single infection, at a single portal of entry, according to Krause, bacilli may come to set up foci in several locations that may be widely separated. From each separate focus, bacilli will drain to tributary nodes where they initiate new foci. Secondary and later visceral foci may attain greater development than the primary superficial focus and in them there may be a more florid multiplication of bacilli than in the latter. Their lymph-nodes may also exhibit a more advanced and apparently an older infection.

In their extension from the periphery inwards, bacilli at first follow the lymphatic channels and pass from node to node or through successive nodes along the course of the lymphatic vessels. If their progress continues they enter the venous system by way of the thoracic duct or by shorter lymphatic trunks directly into the veins.

All particles that reach the veins pass through larger and larger veins to the right side of the heart, are propelled into the pulmonary arterial tree, and then through branches that become smaller and smaller into and through the lungs. The lungs are therefore potentially capable of receiving all foreign bodies that have reached the blood stream after starting at the periphery of the body. Many, perhaps most, of these foreign bodies pass through the lungs and, if they do, are again distributed centrifugally by the arterial system. If they become and remain lodged in the finer capillaries and if they are living bacteria they become possible sources of infection.

This filtration is doubtless also the explanation of the high incidence of metastatic tumor growths found in the lungs. Cases are not

rare where relatively minor primary tumor growths elsewhere may lead to massive or diffuse pulmonary metastases and this metastatic process may be essentially limited to the lungs and broncho-pulmonary lymphatic systems suggesting a complete filtration of the circulating tumor elements from the blood stream by the lungs. As an illustration, a case was recently studied at the United States Naval Medical School, in which a relatively small hypernephroma of a kidney was found together with extensive, small, diffusely distributed metastases in both lungs and in the lymphatics and lymph nodes draining them. Blood clots, fat or other tissue fragments or extraneous substances may also lodge in the capillaries or the arterioles of the lung.

Under these circumstances it might be inferred that a lesion in the lung is commonly initiated by a reaction of the living membrane of the capillaries or finer arterioles and venules in which tubercle bacilli happen to filter out, and this is a view which has been advanced by several authors, particularly Ribbert. Krause, however, from an extensive experience with experimental intravenous infection, especially in rabbits, has never observed a lesion developing within the blood vessels as a result of proliferation of the intima of the blood vessels of the lung. What is first noticeable, he states, is that the bacilli very rapidly are out of the lumina of the smaller vessels. They lie extra-vascularly in the tissue spaces or in the adventitia of the vessels where they are again in contact with the lymphatic system and where they may lodge and produce lesions or be transported further or centralwards through the lymphatic channels. Adventitial or perivascular lesion is a prominent feature of this type of infection. The structures of the lung, the veins, the arteries, and the bronchi are practically inclosed by the ramifications of the lymphatic channels which are in the adventitia of the blood vessels and the fibrous coat of the bronchi. Although exceedingly abundant communications exist between all the lymphatics of the various structures, intrapulmonary lymphatic drainage under normal conditions is always centripetal toward the hilum, and particles that continue in the lymphatic stream finally reach the tracheo-bronchial nodes at the root of the lung.

It is universally recognized that tuberculous infection may exist in the body throughout a long lifetime, but it is also an infection that undoubtedly migrates from time to time throughout the body whether or not its manifestations are noticeable during life. From the preceding description it may be noted that unless a direct lesion of a blood vessel takes place either by trauma or by rupture of a focus into the vessel, tubercle bacilli are always transported by the lymphatics after they have penetrated the surfaces until they are discharged into the blood by the thoracic duct or one of several other

shorter and more direct lymphatic channels. While they are in the vessels the blood simply acts as a passive conveyor, but the tendency exhibited by the bacilli is to leave the blood circulation. They emerge from the vessels through the intermediary of wandering cells which carry them through the intima where they are again in the lymphatic system. If they come to rest here, they may lodge and produce lesions or they may be carried along the paths of lymphatic drainage. It thus happens in regard to tuberculous infection, as Krause points out, that the lungs stand in a relation that is totally different from that of any other organ in the body and that the tracheo-bronchial lymph-nodes are in an entirely different position than are any other lymph-nodes.

RELATION OF THE LUNGS TO TUBERCULOUS INFECTION

The lungs are in direct communication with the outside air and are subject to contact with any substance or substances that may be conveyed into them with the inspired air. With the intake of air through the process of respiration which continues uninterruptedly throughout life at from 18 to 20 times a minute, their position as regards the possibilities of the reception of foreign particles, dust, both organic and inorganic, infectious material, irritating vapors, etc., is entirely different from that of any of the other viscera. In addition, the lymphatic nodes which receive the lymph drained from the lungs, are closely apposed to the trachea and bronchi at the very entrance to the lungs and may, under certain conditions when infected themselves, break down and scatter infection into the organ which they drain.

Both of these circumstances, however, do not take cognizance of all the possibilities regarding pulmonary infection. Another factor is of prime significance. Of all the organs of the body, according to Krause, the lungs are the only ones that are the possible converging points of all particles that have attained the lymph system, no matter where these particles may have entered at the periphery. They are also the converging points of all particles that may have entered directly into the venous system without the intermediary communication of lymphatics. As a result of all these factors it can not be otherwise than that, by and large, the lungs will receive more bacilli and bacilli more frequently than will any other organ of the body. Whether localization of bacilli and manifest development of lesion occur in the lung is a matter that probably depends upon still other factors which will be discussed later.

RELATION OF THE TRACHEO-BRONCHIAL LYMPH-NODES TO INFECTION

To explain the disproportionate frequency and the predominance of tracheo-bronchial node infection Weleminsky (1903-1908) looked

upon these particular nodes as constituting a sort of "lymph heart" to which the lymph from every part of the periphery of the body drained.

Careful anatomical studies, particularly those of Beitzke and Most, both before and since the work of Weleminsky, have demonstrated that all the lymph in the body does not converge toward these nodes. From the lower limbs and lower half of the body the lymph flows through larger and larger channels that finally end in the thoracic duct and thence directly into the veins. From the head and throat and from the arms and upper part of the trunk it ends in small part in the thoracic duct and for the most part by direct channels into the vein. The tracheo-bronchial nodes drain the lower part of the trachea, the lungs, and the heart, and these alone. But in so doing they form potentially at least the converging points for all foreign particles that continue their course as far as the lung. All particles, therefore, that come to lie in the tissue spaces of the lung are in the area of tracheo-bronchial node drainage. It has been shown that particles can reach these tissue spaces by penetrating bronchial mucous membrane or by emerging from blood vessels. If they are then carried into the perivascular and peribronchial lymphatics they will, if lymphatic circulation is competent, and their path unobstructed, be transported to the tracheo-bronchial nodes. As the lungs may be the converging point of all peripheral particles, so the tracheo-bronchial nodes are the converging point of the lungs.

To recapitulate, tubercle bacilli, once they have passed the surface of the body, may or may not set up an appreciable lesion, though it is probable that some local reaction, however minute, always occurs. They proceed toward the interior of the body from the portal of entry by way of the lymphatics and it is likely that some, even though few, are always carried further than the tissues immediately adjacent to the portal of entry. At any point in the lymphatic system they may be filtered out and here again initiate a lesion. If some complete the transit of the lymphatic system they pass into the blood stream where all are at once conveyed to the lungs. Those that go through the capillaries of the lungs follow a divergent distribution and are scattered centrifugally by the arterial circulation. If any come to rest here they are carried out of the peripheral blood vessels, lodge in tissue spaces, and are again in the lymphatic field, in the same way as when they first entered the body, and they or their descendants are again in a position to repeat the same centripetal migratory cycle. Those that lodge in the smaller blood vessels of the lung are soon carried through the intima into the tissue spaces where they are again in the lymphatic field, and from where they can, if their migration continues, be carried to the tracheo-bronchial

nodes. If not completely arrested in these nodes they may be transported into the blood stream through the afferent lymphatics, to repeat the circuit of the lesser or greater circulation or to lodge at any peripheral point in either. As Krause states, toward the lung and tracheo-bronchial nodes distribution tends always to be convergent and cumulative, while away from the lung and tracheo-bronchial nodes it is divergent and dispersive. Again quoting Krause:

This summary is not put forward as a description of phenomena that after tuberculous infection actually and with continuity unfold themselves in all details in every case. It embodies a composite picture that has been built up from a great number and variety of data gleaned from many sources—from experimental and clinical observations of many authors, from anatomical and physiological studies and from personal experience interpreted in the light of harmony with the former. Experimenters have infected animals by many different routes, but most experimental infections have been by inoculation. Inoculation brings about the direct introduction of bacilli into the tissues of animals, a method that usually involves the introduction into the tissues of comparatively large numbers of bacilli. It is nevertheless difficult to imagine how under natural conditions of infection large numbers of bacilli can usually enter the tissues at a given point at a given time. Bacilli can not move themselves through mucous membranes, whether these be of the respiratory or the digestive tract. They must be carried through by cells, and cells will most assuredly not ingest large clumps. It must happen, therefore, that, at particular points of mucous membranes where bacilli penetrate, it is the rule for only a very small number to be introduced at any particular time. Multiplication of those bacilli that gain entrance may, of course, vary tremendously. Given large numbers of bacilli on mucous membranes, many may, of course, be carried in. But it will be at once appreciated that these would represent not one single infection but many separate infections taking place at perhaps dozens of points—yet points that may be very close to one another; and scores of particular time units—yet units that may all be comprised in the space of a few hours. And while the net effect may conceivably be the same as though the same total dose were inoculated with a needle, we do not know this to a certainty. We can be sure, however, that, carried into the tissues in what may be called the natural way, the bacilli will be subject to more determinants of variation of distribution than if similar numbers were introduced at a single moment by a needle.

(To be continued)

INFLUENZA ¹

During last winter and spring there was a serious epidemic of influenza in Japan. This autumn the disease appeared in the form of an epidemic in California about San Francisco Bay. It would seem probable that the appearance of influenza on our Pacific coast was an outcome of last year's Japanese epidemic. From the vicinity

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of San Francisco the disease has spread over the State. Los Angeles was soon hit and at this writing, December 12, 1928, is still suffering severely. Reports of an influenza epidemic like that in California have also been coming from Montana and now epidemics are reported from Missouri and Kansas. Outside of the western part of the country, there have been up to the present no reports indicating an unusual prevalence of influenza anywhere in the East, except in South Carolina and Georgia.

It can not be predicted that the California epidemic will spread over the entire country, but it is not improbable that it will.

The 1918 epidemic which was first recognized in Boston, the last days of August, was not long in reaching the Pacific slope. The epidemic which covered the entire world in that year originated in Asia and moved both west and east. The two waves met on our Pacific coast, but the mortality was much smaller there than in Europe, or in our Eastern States.

It has been said that in spite of all the study which has been devoted to influenza, particularly in the last 10 years, we do not yet know the cause of influenza or how to control it.

In a sense, this statement is justifiable. It is true that studies of influenza have been disappointing. We are not sure of the specific cause of influenza, nevertheless we have discovered some of its characteristics and peculiarities. We have not been able to devise methods of preventing and controlling influenza similar to those by which small pox and typhoid fever are controlled, but we do possess information regarding influenza which if consistently utilized could do much toward checking the spread of influenza in a community and in decreasing its mortality.

It has been established with practical certainty that a person has influenza in its contagious stage before he feels or shows any signs of illness. In other words, influenza like many, if not all other acute contagious diseases, is contagious before recognizable symptoms appear.

To prevent the spread of influenza, therefore, in a community, precautions and preventive measures must be applied to persons who are going about apparently well.

It seems equally well established that the contagious period of influenza is comparatively brief and that an influenza patient ceased to be dangerous to others, so far as transmitting influenza to others is concerned, as soon as his fever becomes well developed. Probably this is why attempts to transmit influenza experimentally in human volunteers have failed. It is not inconsistent with recent discoveries of the effects of heat on pathogenic organisms to imagine the heat of

the fever as indicated by the bodily temperature in influenza serves to kill quickly the infective agent of influenza.

We know, too, that influenza is a general infection, and that, whatever may be the channel of infection, a simple, uncomplicated case of influenza presents no catarrhal symptoms. When there is a cough or indication of inflammation of the nose or throat or lungs, it means complications from some other cause, operative either before or after the influenza infection.

An uncomplicated case of influenza is characterized by its sudden development, a rapid rise in bodily temperature, and profound prostration. A strong young man may feel well and within two hours be unable to walk, and feel indescribably sick.

We have learned that the great danger from influenza is that it makes the patient vulnerable to other potentially infective organisms, many if not most of which would be harmless to the patient if he did not have influenza.

Circumstantial evidence indicates that the increased susceptibility to other infections is related to the physical exhaustion produced by the influenza, and that such susceptibility is further increased by muscular exertion, loss of sleep, or anything else tending to aggravate the exhaustion.

The mortality from influenza is usually from some form or other of pneumonia, probably most often due to pneumococci or certain streptococci, whose proclivities, characteristics, and habits are fairly well understood.

While, therefore, we may now not know the cause of influenza we do know the chief causes of its mortality. Influenza mortality is due chiefly to the same organisms against which surgeons have been contending with increasing success in recent years to prevent deaths of debilitated patients, exhausted by surgical operations.

Pneumococci and streptococci are found for longer or shorter periods in the noses and throats of a varying proportion of the people in any of our communities in this region. The proportion of such "carriers" tends to increase during our colder months of the year. "Carriers" of pneumococci and streptococci may be detected by throat and nose cultures, following a procedure similar to that employed for the detection of carriers of the diphtheria bacilli. As with diphtheria bacilli carriers, the pneumococci and streptococci carriers may be found to be carrying organisms that are "avirulent"; that is, without inherent capacity to do harm, but, as with diphtheria bacilli, also, carriers will be found to be carrying pneumococci and streptococci which are capable of producing most dangerous infections if given the opportunity and the right local or constitutional conditions.

What has thus been learned about pneumococci and streptococci will probably hold true also of other less well-understood organisms which may likewise be capable of causing dangerous complications of influenza, and perhaps also be true of the causal organism of influenza itself.

However this may be, it is evident from what has been stated that a person's chances of dangerous complications or death from influenza are reduced by anything which may lessen his opportunities to pick up, before he gets influenza, the pneumococci or streptococci or other less well-recognized organisms which may cause dangerous or fatal complications in a case of influenza. Also, that when exposed to such dangerous organisms, his chances of escaping serious or fatal complications are favored by conserving his natural powers of resistance to their malevolent action in so far as he can by avoiding physical exertion or anything else tending to physical exhaustion. It is doubtless for this reason that the influenza patient fares best who goes to bed and stays there until two or three days after the fever and indications of complications have disappeared.

Dangerous or fatal complications of influenza may thus be caused by pneumococci or streptococci, and presumably by other pathogenic organisms which the person may have been "carrying" without harm to himself before he was infected with influenza. Or complications and death may be due to the patient's exposure to pathogenic organisms with such dangerous potentialities after he comes down with influenza. Because of the manner in which it has been customary to handle influenza patients in time of epidemics and crowd them in hospital wards, such exposure of patients to complicating infections has been a great factor in the mortality from influenza.

Any procedure or procedures which tend to check the distribution of pneumococci or hemolytic streptococci in a community and thus lessen the number of carriers is going to decrease the mortality from an influenza epidemic when it strikes that community, provided the benefits of such procedures are not offset by exposing influenza patients to complicating infections after they are taken sick.

There are several well-known ways in which pneumococci and streptococci are distributed in a community.

They may be distributed directly by breathing air into which carriers or sick persons in confined spaces have been coughing, sneezing, or even talking forcibly.

The practice of putting more than one member of a family in one bed is likewise accountable for the distribution of pathogenic organisms.

Avoiding crowds and sleeping alone are wise personal precautions when an influenza epidemic is threatening.

Pneumococci and streptococci may be transplanted by eating food handled with fingers which have been unknowingly contaminated by secretions from other persons' noses or mouths. Wash the hands before eating.

Pneumococci and hemolytic streptococci are to be found in the floor dust of rooms occupied by persons suffering from infections with these organisms or who may be merely carriers of them. Any way in which such dust may get into persons' mouths or noses, by breathing the dust, by eating food contaminated thereby, or by any other means, doubtless serves to distribute and transplant the organisms in human beings.

It has been repeatedly discovered and rediscovered in the last 150 years that better health can be maintained among soldiers in barracks if the floors are washed daily.

Pneumococci and streptococci and other pathogenic organisms as well are spread in a community by customary insanitary dish-washing practices. Glasses, cups, forks, and spoons on which the users have left mouth secretions containing such organisms are put in a common dish pan. They, with other eating and drinking utensils, are subjected to a washing process which fails to kill the organisms and by means of the dish-wiping cloth the organisms are distributed on the surface of the apparently clean utensils where they may remain viable for hours and infect the next user of the fork, cup, glass, or spoon.

If one visits a military training camp or a battleship to-day he will find that the eating and drinking utensils are washed in one receptacle and then put in a wire basket and held submerged until sterilized in another receptacle of boiling water. When taken out they are so hot that they dry without wiping.

Unless special precautions be taken, a patient, free from hemolytic streptococci when admitted into a hospital ward where there are carriers of these organisms, will almost certainly become a carrier himself in a few days. This should teach us that not only is rest essential to the safety of an influenza patient, but so is isolation for the patient's own sake.

Such isolation is not effective until it is shown that the nurse or attendant on the patient is not a carrier of organisms which are capable of causing the death of an influenza patient.

In so far as the individual may protect himself against serious consequences of an attack of influenza he may reduce his chances of becoming a carrier of potentially dangerous organisms in advance

of the epidemic by keeping out of crowds, by washing his hands before eating, and by refusing to patronize eating or refreshment places unless he knows that their dish-washing procedure is sanitary.

If he comes down with influenza he should go to bed and stay there, avoid exertion, and endeavor to secure as much sleep as possible.

He should further insist on protection against exposure to infection with organisms dangerous to him, whether from his environment, other sick persons, unsterilized eating or drinking utensils, or from his nurses or attendants. He needs protection from infection of this sort no less than a surgical case for whose protection he will see physicians and nurses even masked.

THE RECENT EPIDEMIC OF INFLUENZA

The epidemic of influenza which began in San Francisco in October, 1928, and then spread throughout most of the United States, has been much less severe in regard to both the numbers of cases and deaths than the great pandemic of 1918. The Weekly Bulletin, Department of Public Health, California, December 22, 1928, states that while it is too early to know the number of deaths that occurred in that State from influenza and pneumonia during the past few weeks, there were about 40,000 cases of the disease since the 1st of October, 1928, as compared with 230,845 cases and 13,340 deaths during the pandemic of 1918.

The greatest number of cases of influenza occurring in a single week was during the week ending December 8, when 10,683 cases were reported. If the present wave of the epidemic is to follow the same trend as the epidemic of 1918 it can be assumed with safety that the epidemic will have disappeared from California within the next few weeks, although there is a possibility, as in 1919, of a second wave occurring in January and February, 1929.

The number of cases of influenza reported in California, by weeks, during the recent epidemic was as follows:

Oct. 6	27	Nov. 10	2, 698
Oct. 13	44	Nov. 17	2, 803
Oct. 20	171	Nov. 24	5, 166
Oct. 27	1, 557	Dec. 1	10, 095
Nov. 3	2, 456	Dec. 8	10, 683

The chief characteristics of this outbreak were the mildness of the attack as compared with previous widespread epidemics, the infrequency of complications, and the resultant low mortality rates. In the 10 years that have intervened since the 1918 epidemic there has been no advance in methods of control of the disease. Its cause

is not known, but it may be stated that Olitsky and Gates (1922), in suggesting the relationship of the *Bacterium pneumosintes*, a gram-negative, anærobic, filterable bacterium, to influenza, reported that control rabbits injected intratracheally with *Bacterium pneumosintes*, and then intravenously with the pneumococcus, streptococcus, or *Bacillus pfeifferi* in doses that had proved noninfective for normal rabbits, uniformly developed a secondary infection with these microorganisms.

Hall (1926) reported the experimental production of characteristic lung lesions in rabbits and guinea pigs with nasopharyngeal washings from a patient with typical epidemic influenza. From one of his affected animals a culture of *Bacterium pneumosintes* was obtained. The presence of this organism in the lungs of experimentally infected animals predisposed them to the pulmonary localization of other bacteria and the production of definite secondary pneumonic lesions.

According to Gates (1926) the presence of *Bacterium pneumosintes* has been demonstrated in nasopharyngeal washings from two patients in a sporadic outbreak of clinical influenza in New York City in March, 1926. Two strains of bacteria morphologically similar to *Bacterium pneumosintes*, but differing in certain cultural characters, and two other anærobic filter-passing organisms were also isolated from the nine patients examined.

The blood serum of 16 among 17 persons convalescent from clinical influenza, and of 6 among 10 supposedly normal persons, agglutinated one or more strains of *Bacterium pneumosintes*.

Kendall (1928) states that the *Bacterium pneumosintes* grows with difficulty in fresh ascitic fluid reinforced with fresh, sterile kidney tissue under strictly anærobic conditions and is culturally inert. It measures 0.15 to 0.3 microns in length and occurs as minute rods with rather pointed ends. It is nonmotile, gram-negative, and subcultures on anærobic blood-agar plates are small, round and clear. It grows at 37° C. D. and T. Thomson have prepared a vaccine containing 25,000,000 of *Bacterium pneumosintes* per cubic centimeter detoxicated with $\frac{1}{1250}$ NaOH, with which they claim to have had some success. Nevertheless, *Bacterium pneumosintes* is not as yet generally accepted as the inciting factor of the disease.

The only practical method of control of influenza lies in the prompt isolation of the individual as soon as he is taken ill, and his continued isolation until after the fever has disappeared. This measure acts to the advantage of the individual, since it tends to prevent the occurrence of complications, and it also tends to protect the general public by the removal and isolation of the sick individual during the fever period, when the disease is supposed to be

highly infective. The general symptoms in epidemic influenza are prostration, fever, leukopenia, headache, backache, pain in the extremities, followed by a persistent cough. The increased temperature generally persists for three or four days. If persons who are attacked in this manner will go to bed immediately and remain there until after the temperature subsides, complications can best be avoided. It is a conspicuous fact that fatalities occur chiefly in sick persons who do not receive proper care and who attempt to keep on their feet in spite of their illness.

A conference of State and municipal health officers was held in Washington, D. C., on January 10, 1929, to consider the then present national epidemic of influenza. The report of the committee on epidemiology was as follows:

The features which have distinguished influenza in its typical pandemic outbreaks, such as those of 1918 and 1889-90, are:

1. A great increase in the prevalence of illness of which the usual symptoms are fever, of more or less sudden onset, of moderately high range and of only a few days' duration; aching of the body and limbs; catarrhal inflammation of the upper respiratory passages, and marked prostration. In its manner of spread this disease has the characteristics of a highly contagious infection, transmitted directly from person to person.

2. Coincident increase in the prevalence of pneumonia developing apparently as a complication of a certain proportion of the influenza cases.

3. A rise in the general mortality rate due largely to increase in deaths certified as influenza or pneumonia. These deaths characteristically show an age distribution different from that of normal times in that the proportion of young adults is increased.

4. In any given locality the epidemic develops and runs its course rapidly so that its duration, even in a large city, is a matter of not more than 5 to 10 weeks.

5. The tendency is to rapid and wide extension, different communities being attacked in such quick succession that the spread across a continent requires only a few weeks, and where the disease becomes pandemic it travels around the world within three to six months.

The epidemics which show the full development of all these features, including world-wide prevalence, are rather rare events, recurring at intervals which usually have exceeded 20 years. However, at much more frequent intervals we have minor epidemics, similar in general character, but differing from the typical picture in some respects, notably in lower prevalence, less severe clinical type, slighter effect on mortality, and less extensive area of spread. The exact relationship which these bear to true pandemic influenza is still a matter for investigation rather than fixed opinion; but the more distinct of the minor epidemics are generally accepted as true influenza of modified virulence and intensity. Since 1919 at least two such outbreaks have occurred in the United States, one in 1920 and one in 1926, with some more doubtful epidemics in other years.

The data available at this time for judging the nature, extent, and severity of the present epidemic are clinical accounts of the cases seen in communities already attacked; official morbidity reports, which are admittedly incomplete and uneven, but have nevertheless a certain significance; and, for the large

cities listed in the Weekly Health Index, weekly reports of deaths from all causes, and from influenza and pneumonia.

All this evidence agrees in indicating the existence of a definite epidemic of influenza. It seems to have developed first in the vicinity of San Francisco early in November. Since that time it has extended, with characteristic rapidity and in fairly regular sequence, until it has now become demonstrable in all sections of the United States except the Northeastern States.

The epidemic is already on the decline in those western cities which were first affected; and has apparently reached its peak in some middlewestern cities, but in the East seems not yet to have reached its full development. The effect on mortality has not approximated that caused by the pandemic of 1918, and has been less than in the epidemic of 1920, but more severe than at any time since the latter date.

For the statistical and epidemiological study of the epidemic we recommend:

1. That the Public Health Service continue and extend its activity in the collection and compilation of morbidity and mortality statistics, to afford both a current and a permanent record of the epidemic.

2. That the Public Health Service undertake special surveys of morbidity in a sufficient number of localities to give a more exact picture of the prevalence and epidemiology of the disease.

3. That State and local health authorities, the military services, and institutions, in addition to collecting their usual records, undertake such statistical and field studies as circumstances will permit, and that they be especially on the alert to take advantage of any opportunities which may be presented for unusually instructive epidemiological observations.

4. We would also call attention to the need for extensive and careful clinical studies, particularly such as will give accurate descriptions of unselected cases, including the milder types of doubtful diagnosis.

The report of the committee on preventive measures was in part as follows:

When influenza is prevalent or is believed to be approaching a community, during the course of an epidemic it is advisable to take advantage of the public interest and concern by emphasizing anew those public precautions and practices of personal hygiene upon which the prevention of communicable affections of the upper respiratory tract depend.

Measures for precaution fall naturally under those of a communal or administrative character and those which apply to the individual:

I. COMMUNAL OR PUBLIC PRECAUTIONS

1. Efforts should be made to reduce the opportunities of direct contact infection by avoiding crowds.

2. Schools or colleges should not be closed wherever adequate medical and nursing supervision is available and provision is made for the prompt exclusion of all persons showing suspicious catarrhal symptoms, especially when these are associated with a rise of temperature.

3. The reopening of boarding schools and colleges after vacation should not be encouraged in the presence of epidemic influenza unless there are generous accommodations for the bed-care of those who may be attacked.

4. While the general closing of places of public assemblage is to be deprecated, there may be local conditions justifying such action at the discretion of the local health authorities.

5. In groups which can be brought under daily professional inspection the isolation of early and suspicious cases of acute respiratory tract infection, particularly when these are accompanied by a rise in temperature, may result in delaying the spread of the disease.

6. In isolated communities and in institutions infection may be delayed and sometimes avoided by the strict exclusion of visitors.

7. The person and sick room of an infected individual must be considered a definite focus of infection, and visitation to such persons or premises should be avoided by all persons except the necessary medical and other attendants.

II. EDUCATION IN CLEANLY PERSONAL HABITS

When influenza prevails or threatens, information on the subject of cleanly personal habits and personal hygiene should be spread widely, particularly with regard to the following points:

1. Avoidance of all uncovered acts as in coughing, loud talking, sneezing, or spitting.

2. Special emphasis upon the good of washing the hands frequently, more especially before eating; unclean articles and fingers should be kept out of the mouth and nose. This advice is particularly applicable to all persons in attendance upon the sick.

3. Avoidance of exposure, fatigue, and any bodily excess.

4. Persons in good health should continue in their normal manner of life.

III. ADVICE TO INDIVIDUALS FOR GUARDING AGAINST COLDS, UPPER RESPIRATORY INFECTIONS, AND INFLUENZA

It would seem advisable that in the presence of influenza or upper respiratory infections individuals should make more than the ordinary effort to increase well-being. This may be obtained by—

1. Securing adequate sleep and rest (8 to 10 hours' sleep every night with windows open, but under enough covering to keep warm).

2. Eating a moderate, mixed diet and partaking freely, at regular periods, of pure water (six to eight glasses daily).

3. Wearing clothing to suit the environment, particularly clothing which prevents chilling of the body surfaces and which keeps the body dry.

4. Avoiding people with colds, especially those who are sneezing or coughing. There is more danger from contact with those just beginning to feel sick than from those ill enough to be confined to bed.

5. Keeping out of crowds so far as possible, especially crowds in closed places.

6. Avoiding the use of common towels, wash basins, glasses, eating utensils, and toilet articles.

7. Washing the hands thoroughly before eating.

8. Avoiding the use of any so-called preventives. Vaccines, sera, and advertised preventives seem to be of no value and may be harmful in this disease.

9. Avoiding alcohol and stimulants of all sorts.

AN OUTBREAK OF CATARRHAL FEVER AT THE UNITED STATES NAVAL TRAINING STATION, GREAT LAKES, ILL.

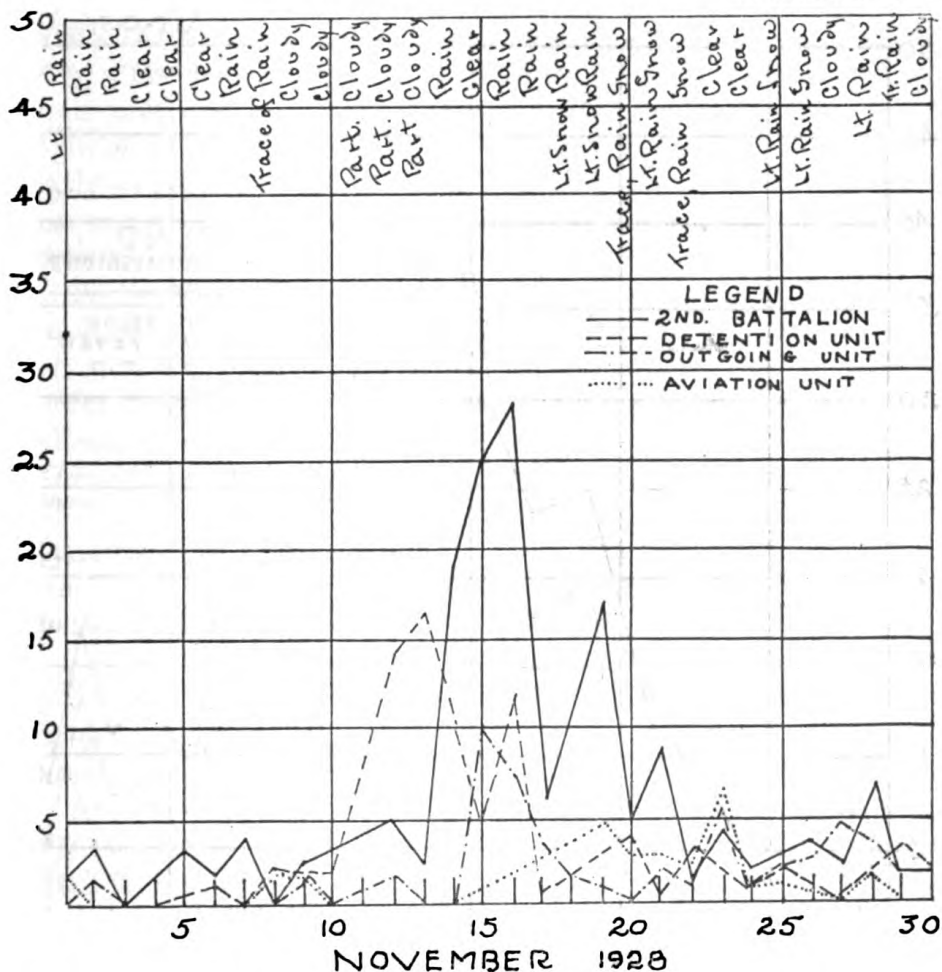
By C. G. SMITH, Captain, Medical Corps, United States Navy

During the month of November, 1928, there was a marked increase in the admission rate for disease on account of an outbreak of acute

catarrhal fever which reached epidemic proportions on the morning of November 12, when 20 patients were admitted to the sick list with symptoms of an acute infection of the upper respiratory tract.

All of these patients were from a section of one company (Company No. 11), which was quartered in one cubicle of Barracks A, Camp Barry, known as the detention unit. Previous to this time nothing unusual had been noticed among the men at the training

Chart A



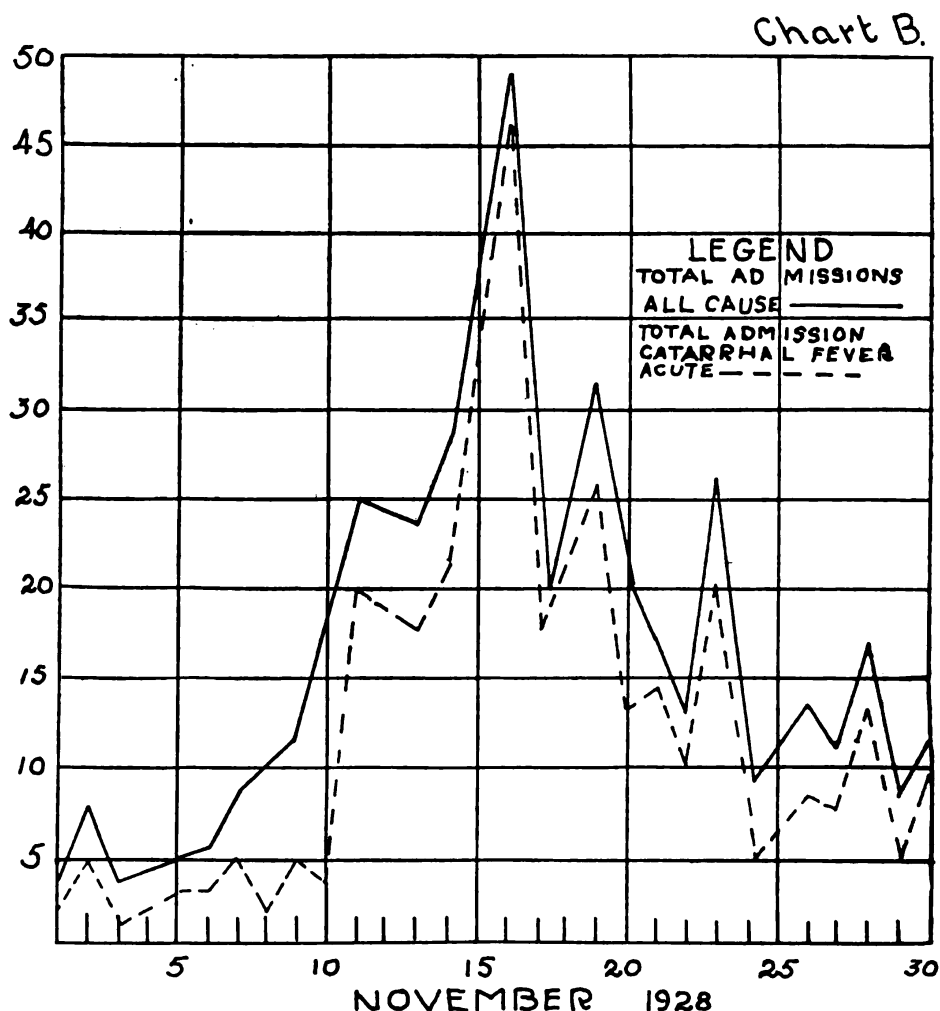
station either regarding the number of admissions or of symptoms suggesting an increased prevalence of acute colds. The incidence of diseases of the respiratory type for the entire station, with an average strength of 1,480 for the month of November, varied from three to five admissions per day.

Within a few days the epidemic had spread to the companies of the Second Battalion, which is composed of recruits released from detention, men of the "ship's company," and those attached to the aviation mechanics' school. Chart A shows the number of admis-

sions in November by days for each unit, together with the weather conditions prevailing at the time.

Chart B shows the total number of admissions in November by days, all causes, and the admissions for catarrhal fever.

Altogether, 313 cases of acute catarrhal fever, 23 of acute tonsillitis, 2 of acute bronchitis, and 1 of Vincent's angina were recorded in November, and 97 cases of catarrhal fever, 17 of tonsillitis, 2 of Vincent's angina, and 1 of influenza in December.



Just previous to the outbreak, the weather had been cold and windy and included several rainy days. Because of these meteorological conditions the recruits had been kept indoors most of the time and occupied with class work which consisted of instruction in knots, splicing, the marking of clothes, etc., where they were brought in rather close contact with each other. There had been, however, comparatively little drilling out of doors so that the elements of fatigue and exposure can hardly be considered as predisposing factors.

The epidemic may have been aggravated by conditions in the barracks and mess hall of the receiving unit. There is no place provided for washing and drying clothes outside of the barracks, and clothes, therefore, must be washed and dried in a room alongside of and opening into the living spaces, a condition which is decidedly insanitary and unhygienic. Also, outside doors for entering the living spaces are so arranged that when opened, practically every man in the room is exposed to a draught. The mess hall for this unit is small and over-crowded, necessitating the serving of meals to recruits in shifts, a condition which is decidedly objectionable. The food is sufficient in quantity, of good quality, and usually well prepared and served, but the senior medical officer is of the opinion that improvement could be made in this connection, particularly in regard to serving food hot, which is difficult to do with the present arrangements. Steam tables and the *caf  teria* system, it is believed, would remedy this defect.

The symptoms observed among those who became affected varied in severity from a simple coryza to those indicative of a mild form of influenza. The temperatures ranged from 99.6   to 103   F. In order to guard against the possibility of cerebrospinal fever, white blood cell counts were made in all cases. ~~In~~ no case did the count exceed 10,000 leukocytes per cubic millimeter, but in about 20 per cent of the cases a leukopenia was found. This led us to believe that at least that per cent of the cases were true influenza and this belief was concurred in by the staff at the naval hospital. A total of 203 patients were transferred to the hospital for further treatment, and up to December 14 three had developed broncho-pneumonia, and one lobar pneumonia. It is gratifying to note that no case of cerebrospinal fever occurred either in November or December. There were no deaths.

At the beginning of this epidemic an effort was made to ascertain the prevalence of the disease in the immediate vicinity, viz, Waukegan, North Chicago, Lake Bluff, Lake Forest, and Fort Sheridan. Except from Fort Sheridan very little accurate information could be obtained, the general opinion of the medical profession being that there was an increase above the normal of acute catarrhal fever, but nothing resembling an epidemic, although there were undoubtedly more cases existing than came under observation. Fort Sheridan reported that there was nothing of the kind among the soldiers of that post. Since then it has become a matter of common knowledge through the daily press that an epidemic of influenza does exist, at least at this time, and I am strongly inclined to believe that the epidemic which we designate as "catarrhal fever, acute," was really the beginning of what is now considered to be influenza. However,

this is more or less an academic question which will have to be determined after further study and observation.

For practical purposes the same precautions would have to be observed for either disease. In addition to sanitary precautions and rules for personal hygiene already in existence, special orders were promulgated for the particular purpose of eliminating the factors of fatigue and undue exposure.

The senior medical officer was particular that every effort should be made by his staff to detect early and bring under treatment promptly anyone at all ill, this not only to give the patient a much better chance for quicker and complete recovery, but also for the purpose of preventing the spread of the epidemic.

The following sanitary regulations were submitted to the commanding officer for his consideration with the recommendation that they be adopted and enforced:

(a) Under no circumstances will more than 18 men be quartered in each cubicle of Camp Barry. The sleeping arrangements will be as follows: 14 men to sleep in hammocks in the regular sleeping quarters and 4 men will sleep on cots in the living quarters.

(b) Under no circumstances will more than 79 men be permitted to sleep in the dormitory spaces of Barracks A, B, C, and D, nor more than 63 men in the living room of these barracks.

(c) Every man sleeping in a hammock must have a sneeze screen hung between his hammock and the adjoining one.

(d) *Temperature of barracks.*—The optimum temperature of living quarters is 68° F. During the day when the quarters are occupied and up until the time the men turn in the quarters should be kept at a temperature of from 68° to 72° F. From 10 p. m. until reveille the temperature should be kept between 55° and 65° F.

(e) While the men are out drilling all rooms should be thoroughly ventilated and then the windows closed until the rooms have reached a temperature of 68°. Thereafter the ventilation shall be so regulated as to give fresh air (guarding against draughts) but not letting the temperature fall below 68° during the day and 55° F. after turning in.

(f) Men who get wet feet while drilling or standing guard must be instructed to return to their barracks as soon as possible, remove shoes and socks, and after drying their feet put on dry footwear. The same rule pertains to wet clothing.

(g) During inclement weather recruits must not be allowed to stand waiting outside of the mess hall or movies. It should be arranged that men are marched direct from their barracks into the mess hall or movies.

(h) *Sterilization of dishes.*—All dishes and mess gear must be placed in boiling water after washing and allowed to remain for two minutes before removing.

(i) Bedding shall be aired daily, outside weather permitting. When the weather is inclement, bedding must be aired inside.

Other information is contained in the pamphlet entitled "Personal Hygiene" issued to each recruit upon arrival and which in part is as follows:

Transmission of disease.—Many diseases are transmitted through discharges from the nose and mouth. For this reason, never cough or sneeze in another person's face; always cover your mouth and nose with your handkerchief. Never smoke another man's pipe or cigarette butts or use another person's toilet articles, wash bucket, or towel.

Cleanliness.—Cleanliness promotes comfort and self-respect, improves morale, and tends to prevent diseases which gain entrance to the body through the skin. You should take a bath daily or at least every other day. Take a warm bath, use soap freely on the hairy parts of your body, rinse off with warm water, and then finish up with a dash of cool or cold water. Be sure to dry your head well before going out in cold weather.

Care of the feet.—Much of your body comfort, especially during recruit training, depends upon the proper care of your feet. Bathe your feet in warm water every night, using soap, then rinse with cold water and dry well, especially between toes. Keep toenails trimmed close. Cut big toenails straight across. Change socks daily. Do not wear socks with holes in them. Do not allow your socks to wrinkle. If you have blisters on your feet, come to the sick bay and have them dressed.

Care of the teeth.—Every man in the Navy should take good care of his teeth, because: Good health and physical fitness depend largely on the care and preservation of the mouth and teeth. If you neglect your teeth, serious illness, permanent disability, and disfigurement will surely follow:

The dental department of the Navy maintains facilities for the care and treatment of the teeth of all members of the Navy personnel, and these facilities are open to you. Observance of the following rules will tend to preserve sound teeth and a healthy condition of the mouth:

Brush the teeth after each meal with a good stiff brush, using tooth paste or common table salt and water.

See the dental officer of your ship or station at least every six months.

Do not wait until a tooth becomes painful before seeing a dental officer; if you do, it will probably be too late to do anything but extract the tooth.

Constipation.—Your bowels should move once daily. If you are constipated, do not wait two or three days before coming to the sick bay. Constipation is often due to insufficient fluids in the body. Make it a rule to drink from six to eight glasses of water a day in addition to the fluids you take at meals. Have a regular time to attend to the call of nature and go to the head at that time, even if you do not feel as if you needed to. On arising in the morning, brush your teeth well and then drink a glass of water.

AN OUTBREAK OF INFLUENZA ON BOARD THE U. S. S. "MELVILLE"

By J. T. PARKER, Lieutenant (junior grade), Medical Corps, United States Navy

During the period from November 20 to December 20, 1928, a total of 100 cases of influenza were treated on board this vessel, which was anchored at that time in San Diego Bay, Calif. Of these, 65

cases were from destroyers of the Eleventh Destroyer Squadron, Battle Fleet, and the remaining 35 cases from the crew of this vessel. All of the cases were treated in the sick bay of the U. S. S. *Melville*.

In all cases the course of the disease was mild as compared with epidemics previously reported elsewhere, and no complications or deaths resulted. The recorded temperatures in most cases gave a saddle-back type of temperature chart with a rapid initial rise ranging from 102° to 103° F. and then dropping to nearly normal. In the course of a few hours a secondary rise to within a degree or so of the primary elevation was observed, after which the fever gradually declined and became normal in about 48 hours.

During the initial rise the symptoms experienced were headache, pharyngitis, a sensation of tightness in the chest, and cough accompanied by a feeling of malaise and soreness in the muscles of the back. As the temperature declined the symptoms subsided, but when the secondary rise of temperature occurred the feeling of malaise returned in a milder form. The pulse was accelerated in proportion to the temperature, but respiration remained about normal. The white blood-cell count showed the leukopenia described in typical cases of influenza. Most of the patients were ready for duty in four days. At the present time, December 24, 1928, the outbreak seems to be about over with only an occasional admission for this disease.

PRACTICAL POINTS ABOUT ACTIVE IMMUNIZATION AGAINST DIPHTHERIA AND SCARLET FEVER¹

By WILLIAM H. PARK, M. D., Fellow A. P. H. A., and MAY C. SCHRODER, M. D., Director and Assistant Director, Bureau of Laboratories, Department of Health, New York, N. Y.

Probably the most important point at present under discussion in the immunization of children against diphtheria is the preparation to be used. There are four preparations now available: Toxin, nearly neutralized with a trace of antitoxin produced in horses; toxin nearly neutralized with antitoxin produced in goats; and toxin modified by exposure to moderate warmth and a small amount of formalin, so that it becomes practically free from toxic action. This is called anatoxin or toxoid; and finally toxin modified by the action of formalin to a lesser extent so that it is chiefly toxic. This is also called toxoid, but not anatoxin.

In the United States and Germany, toxin-antitoxin is chiefly used; in France, anatoxin; and in England and Canada, the slightly toxic or nontoxic toxoid. The choice of the different peoples is largely

¹ Read before the Health Officers' Section of the American Public Health Association at the fifty-seventh annual meeting at Chicago, Ill., Oct. 17, 1928. Reprinted from the American Journal of Public Health, Vol. XVIII, No. 12, December, 1928.

accidental and to some degree influenced by patriotic reasons rather than by the especial value of the product.

Ramon recently has contrasted the virtues of anatoxin with the drawbacks of toxin-antitoxin.¹ The recognized importance of Ramon's opinion because of his having developed anatoxin causes us to consider his objections in detail.

His first objection is that toxin-antitoxin is very difficult to make, and that because of this difficulty serious accidents have occurred and probably will occur in the future from its use. Having produced both preparations, we are certain that both are made without difficulty by experienced workers.

As to accidents, there have been three major ones and one minor. The first major accident was at Dallas some years ago, where through a mistake a preparation was sent which contained a large amount of free toxin and a number of deaths occurred. The next was in Vienna, where due to carelessness, vials of dilute toxin were sent out which were of similar appearance to those holding toxin-antitoxin. Some of these were used in place of toxin-antitoxin with serious results.

The third accident was in Australia where toxin-antitoxin was sent out without any antiseptic. This was contained in rather large bottles from which the product was taken from time to time for the injections. The third drawing from the contents of one bottle taken some days after the first caused a number of deaths. The examination showed that the fluid was badly contaminated by virulent staphylococci. The first two drawings from this bottle had produced no injury, so that it must have become contaminated during the second drawing. These accidents were all due to carelessness and certainly had nothing to do with the nature of the preparation.

The minor accident happened in Boston several years ago, when the surprising fact was discovered that freezing of the old preparation temporarily separated from its combination in the toxin-antitoxin enough toxin to cause on its injection serious but not fatal reactions. This separation does not take place with the present universally used 1/10L+ mixture. This objection of Ramon, that the nature of the preparation of toxin-antitoxin leads to accidents, is certainly not founded on fact. We have never had accidents in New York City from its use in hundreds of thousands of children. Ramon's second objection is that toxin-antitoxin is slow in producing immunity. In our experience, which is quite large, there is no appreciable difference between the two preparations. Different preparations vary in their immunizing potency and, of course, if a good one of anatoxin is contrasted with a poor one of toxin-antitoxin there will be a difference.

Ramon's third objection has more validity and has been voiced by many. It is that the minute amount of horse globulin added to

the toxin sensitizes those receiving it to later injections of horse antitoxin or other antibodies, such as are used in tetanus, scarlet fever, meningitis, and diphtheria. He fails to realize that the objection if well founded can be easily obviated by substituting goat or sheep produced diphtheria antitoxin for that produced in the horse. This is already being done extensively and on an increasing scale. The goat and the sheep are sufficiently widely separated in species from the horse, so that at least in the amount used their serum does not sensitize persons to later injections of horse serum. Should this change be made? There is no doubt that the percentage of minor skin reactions following intracutaneous tests increases for a time in those who have had injections of horse antitoxin-toxin, but in several instances where we have had the opportunity of comparing the reaction in large groups of children there has been no appreciable difference between the reactions in those who had and those who had not had toxin-antitoxin previously. There is also no doubt that reactions due to serum have been improperly laid to sensitization by previous injections of toxin-antitoxin.

Certainly no serologist would agree that such an example as that recently recorded in the Journal of the American Medical Association was due to sensitization by toxin-antitoxin. A nurse one year after having been immunized with toxin-antitoxin developed sinus trouble with a possibility of a complicating diphtheria. Ten thousand units of diphtheria antitoxin were given. Four days later she developed a moderate case of serum sickness. Ten days after having received the dose of antitoxin serum she was given another dose of 20,000 units; she immediately developed an alarming attack of serum sickness. There was marked swelling in the tissue of the thigh where the serum was given. This finally progressed to such an extent that local gangrene developed. The sensitization here was certainly due to the injection of the serum given 10 days earlier and not to the toxin-antitoxin of the previous year, for otherwise the severe reaction would have developed with the first dose of serum.

While it is true that we are more accustomed to using horse antitoxin to add to our toxin and that we do not ourselves fear sensitization, yet because many physicians fear the minute amount of horse serum, we think we should within a reasonable time substitute goat antitoxin for the horse antitoxin. Both preparations give equally good results. It is the antitoxin and not the animal which produces it which is of importance.

The problem remains as to whether goat or sheep toxin-antitoxin or anatoxin is the better immunizing agent. We have found each preparation when properly selected to be equally good. An injection of toxin-antitoxin gives somewhat less reaction in the children of school age, and the toxoid or anatoxin in infants and the younger pre-

school children. Fortunately, therefore, each health officer can choose the preparation he prefers, and if it has been properly tested for potency in the laboratory he can count on good results.

The next subject we choose as appropriate to take up is a modification of the Schick test. The extra labor involved in the Schick test has caused its pretty general disuse in the campaign for the active immunization of pre-school children and, in country districts, in the school children also. Five years ago we tested the possibility of using the first dose of toxin-antitoxin as a test for immunity as well as an immunizing agent. We found that the properly standardized preparation of which the injection of 1 cubic centimeter would usually cause the death of a 250-gram guinea pig would serve the double purpose. It should be given strictly subcutaneously and as superficially as possible. We found the anterior part of the arm just above the elbow the best place for the injection. Anatoxin can not be used for this purpose, as the reaction due to its injection is produced by other proteins and not by diphtheria toxin. In young children the toxin-antitoxin reaction parallels the Schick reaction. In older children there is a 10 to 20 per cent increase of positive reactions. Some of these are persistent pseudo reactions. The error if present is on the right side. The reading of the reaction should be delayed until the sixth or seventh day to allow the pseudo reactions to largely disappear. Inspected on the sixth or seventh day, the children showing a reaction are given a second dose, while those showing no reaction are allowed to go without further treatment. A week or 10 days later the third injection is given. In those using this method for the first time it is well to control the test in some of the children by an additional Schick test. We have found this method a very useful one where the Schick test is not to be done. It is in use in the public schools and in the baby health stations in New York City. This test should not be substituted for the Schick test in a retest.

The retest.—As three injections of even the best preparations of toxin-antitoxin or of anatoxin or toxoid do not give over 90 per cent immunity on the average, a retest should always be suggested. If the offer is not accepted the health officer has at least done his part. Without this test no parent is certain that the child is immune. The retest should not be done earlier than the end of three months, as some children are slow in developing immunity. With a retest a control test is always advisable.

Should those who have once been successfully immunized be reinjected in later years? Our experience has taught us that there is a slight tendency for a small percentage of cases to gradually revert to their former positive condition. It is very hard in cities to follow the children. They leave their institutions or move to new

homes and addresses are lost. We have been able, however, to follow a few children and a much larger number of adults. The following summaries give the results of retests made eight years after the original injections:

THE PERSISTENCE OF A NEGATIVE SCHICK TEST IN CHILDREN WHO WERE IMMUNE THROUGH NATURAL CAUSES OR WHO WERE IMMUNIZED BY TOXIN-ANTITOXIN

Eighteen infants and young children who gave a negative Schick test in 1919 when retested in 1926 were all negative.

Twenty-five infants and young children who were positive in 1919 and received two injections of toxin-antitoxin when retested in 1926 gave negative reactions in 23, a positive reaction in 1, and a doubtful reaction in 1. This was probably a pseudo reaction.

Either 92 or 96 per cent retained their immunity.

THE PERSISTENCE OF A NEGATIVE SCHICK TEST IN ADULTS WHO WERE IMMUNE THROUGH NATURAL CAUSES

Twelve hundred and ninety-five adults tested in 1920 gave 1,115 negative reactions with no pseudo reaction and 180 negative pseudo reactions.

At the retest in 1928 the 1,115 which had given no reaction gave the following results: 990 were absolutely negative, an additional 144 were negative but gave a protein or pseudo reaction.

Forty-nine gave a positive reaction without a pseudo reaction and 32 gave with a positive reaction also a pseudo reaction.

The results indicated that 93.4 per cent retained their naturally acquired immunity for eight years.

The 180 which were considered to have given a negative pseudo reaction showed the following results at the retest in 1928.

Fifty-eight gave negative reactions; 91 gave pseudo reactions; 7 gave positive reactions; 24 gave combined reactions; and 83 per cent remained immune.

THE PERSISTENCE IN ADULTS OF ACQUIRED ACTIVE IMMUNITY AS SHOWN BY A RETEST EIGHT YEARS LATER

One hundred and seventy-eight adults originally giving a positive Schick test became negative in 1920 after one or two series of two injections of toxin-antitoxin.

Retested in 1928 the following results were obtained:

	Per cent
81 were negative without pseudo reactions.....	45.5
31 were negative with slight pseudo reactions.....	16.8
	<hr/>
	62.3
34 were probably negative with marked pseudo reactions.....	19.0
	<hr/>
	81.3
33 were positive with or without lesser pseudo reactions.....	18.5

We find, therefore, that 62 per cent retained their immunity and that an additional 19 per cent probably did. It is fair to consider that at least 75 per cent of those actively immunized retained and 25 per cent lost their immunity obtained through the stimulus of toxin-antitoxin. There is a possibility that this immunity may have been reinforced in some way by their having become carriers of diphtheria bacilli at some time during the eight years.

The results of these tests suggest that the lapses are not great enough to make it necessary to reinject or retest as a public-health measure. Children seem to hold their immunity somewhat better than adults, possibly because nonimmune adults have shown a resistance to the natural causes which produce immunization. We must remember that in time of exposure we are never certain that a person's immunity has persisted.

Is a negative Schick test a guarantee of immunity? We have not space to consider this fully. If there is sufficient antitoxin in the skin of a child to neutralize an intracutaneous injection of one-fiftieth of a minimum fatal dose of toxin for a guinea pig, we do not believe that a child can develop diphtheria. Nevertheless, we should always advise that antitoxin should be given in any child really suspected of having diphtheria. Why? The technic of the injection of the diluted toxin may be incorrect in a given case such as the needle going a little too deep or the full amount of fluid not being delivered, or the toxin may have lessened in potency because of aging or because of being preserved in improper glass. We must not think, on the other hand, that because a case has a positive culture the case is necessarily one of diphtheria. A case of tonsillitis due to other germs can perfectly well be a carrier of either virulent or nonvirulent diphtherialike bacilli.

ACTIVE IMMUNIZATION AGAINST SCARLET FEVER

It is doubtful whether we have made striking progress since Gabrischewsky in 1907 proposed the use of a vaccine made of the culture fluid and streptococci. Since his first dose of 0.5 cubic centimeter of vaccine produced a rash like that of scarlet fever in 13 per cent of the children, it probably contained between 2,500 and 5,000 Dick skin-test doses. As the second dose was double the quantity of the first, and the third was double the quantity of the second, he probably gave in the three injections about 25,000 skin-test doses. Gabrischewsky died shortly after he published his results; but his work has been carried on by others. They report that the vaccinated children in the villages of Russia where scarlet fever is abundant rarely develop scarlet fever, while the unvaccinated frequently develop it.

The brilliant discovery of the Dicks that the filtrate of the culture could be used when given in proper dilution as a test for immunity

in the same way as the Schick test for diphtheria, enabled us to decide on those who needed immunity; gave us a method of determining the duration of immunity; and allowed us also to estimate the amount of toxin given in the immunizing injection. It was found that moderate amounts given in three to five doses at intervals of one week or more produce immunity in a short time in the vast majority of children.

EARLY IMMUNIZATION IN NEW YORK CITY

Our earliest attempts to immunize children were made with comparatively small amounts of toxin. At first we gave only 1,500 skin-test doses divided into three injections. We found fairly good results so far as immunization was concerned, but it did not hold. We then increased the amount to 4,000 and then to 12,000. We got very good results with 12,000 skin-test doses divided into 5 injections. These were: 700, 1,200, 2,100, 3,000, and 4,000 skin-test doses. At the end of four weeks, 91 per cent of the children gave negative Dick tests and 7 per cent gave doubtful tests, leaving only 2 per cent definitely positive. Even with these larger doses we found immunity did not last beyond six months in many of the more positive children. We then still further increased the amounts with the hope that the duration of immunity might be greatly increased. The doses we are now using are 1,000, 5,000, 10,000, 15,000, and 15,000 to 30,000 skin-test doses. The injections are given at weekly intervals or at slightly longer intervals.

The following three tables give an idea of the changes which have taken place in dosage during the past few years. Similar changes have taken place in the practice of others. Thus in the Journal of the American Medical Association, May 16, 1925, the Dicks give a table showing the increased amount of immunizing power of different doses. Thus when 1,000 to 2,000 skin-test doses are given they find 14 per cent of the children become completely immunized; when 5,000 to 6,000, 66 per cent; and when from 10,000 to 12,500, 91.8 per cent.

TABLE 1.—*Results of injecting 200, 400, and 800 skin-test doses as shown by original retests made by Doctor Schroder in 100 positive cases at St. Dominicks 5 months and 13 months afterwards*

Retest at 5 months—		Per cent	Retest at 13 months—	
++	-----	0	++--	20 per cent very susceptible.
+	-----	8 9.8	+---	9 per cent susceptible.
±	-----	27 33.3	±---	14 per cent doubtful.
—	-----	46 56.8	----	57 per cent immune.
Total	-----	81	Total	100

Before the publication of this table we obtained some interesting results on retests which are seen in Table 1. Although from 1,000 skin-test doses divided in 3 injections, we found on retesting at the

end of five months no strongly positive reactors remaining, and but 10 per cent of moderately reacting. At 13 months, however, we found 20 per cent again giving strong positive reactions. The Dicks and others had the same experience, and so the doses and the number of injections have been mounting until they are giving five doses containing altogether over 100,000 skin-test doses. These large doses are given wholly with the hope of producing a more lasting immunity in the strongly reacting children. They give to about 98 per cent of positive children a negative Dick reaction. Table 2 shows that with 10,000 skin-test doses very good results for the immediate season were obtained by us. Table 3 gives the results in our children following larger doses. In the course of another two or three years we will definitely know whether in order to obtain prolonged immunity we should give 100,000 or more test doses.

TABLE 2.—*Results of five immunizing injections at the end of three and one-half months approximately 500, 1,000, 2,000, 3,000, and 4,000 skin-test doses*

After 3½ months	
32++or++1.....	1=+ 81 per cent immune.
Strongly positive cases.....	5=±=17 per cent probably immune.
	23=-=2 per cent probably susceptible.
	*3=± negative pseudo.
37+or+1.....	34=-.
Moderate reactors.....	*1=+ negative pseudo 100 per cent immune.
	*2=± negative pseudo.
69+to++1.....	1=+ 91 immune.
All positive reactors.....	5=± 7 per cent probably immune.
	57=- 1 per cent probably susceptible.
	1=+ negative pseudo.
	5=± negative pseudo.

TABLE 3.—*Results at different intervals after giving larger doses of scarlet fever toxin divided into five doses*

Number of children giving positive reactions	Time since immunization of retest	Amount of toxin	Per cent immune
40.....	6 months.....	31,000	71
60.....	8½ months.....	46,000	84
56.....	11 months.....	31,000	68
11.....	14 months.....	31,000	82
19.....	15 months.....	26,000	80
16 ¹	2 years.....	31,000	37.5

¹ The number watched for two years is too small to be considered as determining the average duration of immunity.

The persistence of immunity in those who have become naturally immune is encouraging. Thus we found:

RETESTS ON CHILDREN ORIGINALLY NEGATIVE

Of 140 negative children 27, or 19 per cent, were moderately positive 13 months later. Those cases which show pseudo reactions

* 1 and * 5± are considered negative pseudo reactions because of an equal reaction in the control neutralized by convalescent serum.

equal to the toxin reaction are called negative pseudo, although they may be combined.

In the general local treatment of the children receiving the immunizing injections, we have found it useful to give them a laxative on the day of the injection and to apply wet dressings, usually using boric-acid solution, to any children who show an inflammatory reaction in their arms. With these doses we have not had any general rashes develop but the first and second doses sometimes cause a local inflammatory reaction and sometimes vomiting and a rise of temperature.

The Russians still continue to give with the toxin the dead streptococci as first suggested by Gabrischewsky. Whether this method has any appreciable advantage over the pure toxin is doubtful. The aim is to develop antibacterial as well as antitoxic immunity. Some of the American biological plants also distribute such a vaccine. The Larsen preparation of toxoid has been employed by many. We have found that four or five doses are required to obtain nearly 100 per cent of immune children. It does not seem to us to have any advantage over the toxin.

THE CONTROL TO THE DICK TEST

In making careful tests for immunity to diphtheria, we give alongside of the Schick test a control test of heated toxin. The toxin itself is slow in developing a reaction and this does not reach its height until the fourth day, while the protein substances left in the heated toxin produce in sensitized persons a quick reaction which is generally of short duration, although in a few cases it may persist for several weeks. With the Dick test the toxin acts like the pseudo reaction in the Schick test as well as that from the control heated toxin in the Dick test; that is, the Dick test and the control test give identical reactions which show their greatest extent at the end of 24 hours. It is, therefore, impossible to be sure when the control test is similar to the Dick test whether it is a pseudo reaction indicating immunity or a combined reaction indicating susceptibility. In children who have received no vaccination there are few pseudo reactions, but in those who have received the large injections of vaccine now in vogue, we get a good many pseudo reactions. An added difficulty is that even boiling for three hours does not destroy all the toxin. This is determined by the fact that the apparent pseudo reaction in some children is prevented by mixing the boiled toxin with scarlet fever convalescent serum. There is a considerable difference in the amount of pseudo reactions developed by the injection of different preparations.

THE RELIABILITY OF THE DICK TEST

The Dick test in our opinion is almost, but not quite, as reliable as the Shick test. The same care must be taken that the toxin is properly standardized and that it is placed in vials of proper glass. The toxin is more resistant than the diphtheria toxin and can be distributed already diluted. The difficulty with the Dick test is that, as the toxin can only be properly tested in the skin of human beings, it is not apt to be as thoroughly tested as the diphtheria toxin. Also, because there are other streptococci, which belong to different types, which cause fever and scarlet rashes, these may infect those who give a negative Dick test. Such streptococci are, however, in a great minority. The Dick test as a retest is less reliable because of the occasional difficulty of separating the toxin reactions from the pseudo reactions. The occasional errors are, however, on the safe side.

How generally should scarlet fever vaccination be employed? This is a very debatable question. In the first place, scarlet fever at the present time is a rather mild disease in most sections of the country. The deaths in New York City, for instance, are less than 1 in 100,000 persons. The cases, however, amount annually to 10,000 to 20,000. The five doses of the toxin are also a disadvantage. While immunization is rapid it is not always lasting with our present dosage in those who were strongly positive. We can not yet expect to develop an immune population. In a personal communication the Dicks inform me that the injection of a total of 100,000 or more skin-test doses divided in five injections produces an immunization in about 98 per cent which lasts for at least two years. At present therefore we only urge that it be given to all nurses who expect to be in contact with scarlet fever and to all children in institutions. We advise that it be used in schools and families where exposure to scarlet fever is imminent because of outbreaks in the neighborhood. When a case of scarlet fever breaks out in a family or institution, we prefer to do a Dick test on the inmates and to begin active immunization of those who have been exposed or who may be exposed rather than to give scarlet fever antitoxin. The scarlet fever antitoxin only gives an immunity lasting from 10 days to 2 weeks, and at present is more apt to produce serum sickness when injected into human beings than does diphtheria antitoxin.

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SEPARATION OF GROUP IV PNEUMOCOCCI INTO RECOGNIZABLE TYPES¹

During 1927 and 1928, 55 to 60 per cent of the pneumonias in this city were due to pneumococci of Types I, II, and III, and 40 to 45 per cent were caused by pneumococci hitherto classed as Group IV.

Group IV is not a single type and until recently was thought to consist mostly of heterogeneous strains. The strains of the so-called Group IV, isolated during the winter of 1927-28, were studied at the research laboratory of the department of health and 58 per cent of these strains fell into 10 definite types. The remaining 42 per cent may be heterogeneous, or additional types may be separated when the strains are further studied. The 10 new types are designated by Roman numerals from IV to XIII, carrying on the numbering from the Types I, II, and III already recognized.

The mortality in cases infected with Types IV to XIII, inclusive, was 34 per cent. The prevalence and mortality of cases infected with each of these types and with the remaining group of undifferentiated strains were calculated in the limited number of cases studied. They were as follows:

Types	Percent- ages of cases of former Group IV infected with each type	Percent- age of deaths in each type	Types	Percent- ages of cases of former Group IV infected with each type	Percent- age of deaths in each type
IV.....	15.8	36.8	XII.....	3.3	50.0
V.....	5.0	83.3	XIII.....	3.3	0
VI.....	5.8	28.6	Types IV to XIII.....	58.3	34.5
VII.....	9.2	18.2	Undifferentiated strains of so- called Group IV.....	41.7	29.2
VIII.....	3.3	25.0	Former Group IV.....	100.0	32.0
IX.....	5.0	16.7			
X.....	4.2	60.0			
XI.....	3.3	25.0			

Agglutinating antisera for determining the presence of the types are being prepared and several are now available. In addition to this, monovalent therapeutic antisera for use in infections of each of these types are being prepared. These will be ready early in 1929 for observational use. The possibility of preparing a polyvalent antiserum for use with several or all of these types is being studied.

The therapeutic antisera being distributed at present are suitable only for the treatment of cases infected with pneumococci of Type I or Type II. These antisera, prepared by injecting horses with Type I and Type II pneumococci, have been found to have no appreciable protective power against the Types IV to XIII. This

¹ Reprinted from the City of New York Department of Health Weekly Bulletin, Vol. XVII, No. 48, Dec. 1, 1928.

shows that an antiserum to be effective in therapy should be prepared by injection of a strain of the same type as the infecting strain.

REPORT OF A FATAL CASE OF ACUTE POISONING BY NEOARSPHENAMINE

By C. I. Wood, Lieutenant Commander, Medical Corps, United States Navy

The intravenous administration of drugs is of such a common every-day occurrence that some of the dangers and the untoward results that occasionally happen might be relegated to the subconscious mind were they not presented from time to time.

According to the Annual Report of the Surgeon General for the year 1927, there were 55,651 doses of neoarsphenamine administered intravenously to the personnel of the United States naval service during the year 1926. In 29 cases severe reactions were reported, but in only 5 were the symptoms of poisoning recorded as alarming in character. Four cases proved fatal. The immediate cause of death was recorded in each case of poisoning by neoarsphenamine as of the acute hemorrhagic encephalitis type. Repeated convulsions preceded death in every instance. Post-mortem examination showed edema and injection of the brain in all cases. In one case hemorrhagic exudates were found in the liver, kidneys, and spleen. Acute nephritis was found in two cases. In the four cases convulsions began 24, 48, 55, and 72 hours respectively after the administration of the dose immediately responsible for poisoning. In the same order of cases, death occurred 44, 118, 75, and 96 hours after the administration.

The case here presented is unlike any of the above cases reported in that it was of sudden fulminating onset, and proved fatal in less than one hour. The patient, an enlisted man serving on board the U. S. S. *Sinclair*, received the fatal dose of neoarsphenamine, 0.9 gram, on board the U. S. S. *Melville* at about 10.15 a. m., November 10, 1928. The history is as follows: White male, age 38 years, weight 228 pounds. He gave no syphilitic history, but his Kahn test was reported as four plus on three successive occasions in two different laboratories. He then applied to his medical officer for treatment. Neoarsphenamine was administered as follows:

	Gram		Gram
Sept. 29, 1928.....	0.25	Oct. 27, 1928.....	0.90
Oct. 6, 1928.....	.90	Nov. 3, 1928.....	.90
Oct. 13, 1928.....	.90	Nov. 10, 1928.....	.90

No reaction was experienced from any of the doses except the last one.

The urine was examined for the presence of albumin prior to administration of the drug on each occasion and found negative. He

had eaten no breakfast, according to instructions, and was of normal appearance. He was the twenty-sixth patient of a total of 29 given the same drug of the same lot number the same morning, none of the others having experienced any untoward results.

The neoarsphenamine, which may be designated by Lot No. B, was procured in a lot of 600 ampules from the United States Naval Medical Supply Depot in July, 1928, and 150 of these had been used during the five weeks prior to November 10, 1928. There had been no ampules of arsphenamine on board for a long period of time and the present Lot No. B of neoarsphenamine was the only organic arsenical preparation on board for several weeks. The last neoarsphenamine on board was from another manufacturer and the supply had been exhausted. The labels on all the ampules used the morning on which the fatal reaction occurred, were saved, inspected, and all were found to be of the same Lot No. B of neoarsphenamine.

The ampule was inspected after immersion in alcohol and was normal in appearance. Its contents were dissolved in 20 cubic centimeters of sterile freshly distilled water at room temperature and the resulting solution was injected intravenously after filtering, allowing five minutes for the injection.

Three or four minutes after he had received the drug he began to cough, became cyanotic, dyspneic, and expectorated white, frothy fluid which had the appearance of beaten white of egg. One gram of sodium thiosulphate was given intravenously at this time. This was followed five minutes later with 15 minims of 1-1000 adrenalin hydrochloride intramuscularly. He continued to complain of difficulty in breathing and as he was raising more white frothy fluid he was given one 1/150 grain of atropin sulphate intramuscularly. His head and neck especially were extremely cyanotic. The pulse was of fair quality but auscultation of heart sounds was not possible on account of coarse bubbling râles in the chest, accompanied by marked dyspnea. The patient was conscious and upon being questioned stated that his only difficulty was inability to breathe. Six minims of adrenalin were given intravenously one-half hour after the neoarsphenamine administration. He said he felt as though he was going to have a bowel movement but no movement resulted after a bed pan was provided.

He ceased to breathe at 10.50 a. m., but the heart's action was very weak for a short time longer and white frothy fluid drooled from mouth. He was pronounced dead at 10.55 a. m., which was just 40 minutes after receiving the neoarsphenamine injection. There were no convulsive seizures at any time.

The remains were removed to the United States naval hospital, San Diego, Calif., where an autopsy was performed four hours later

by Lieut. Commander H. S. Summerlin, Medical Corps, United States Navy, with results as follows:

The body is that of an obese white male of about 30 years. The face and neck are of a deep purple color. There is white froth coming from the mouth and nose. Body heat is present, rigor mortis has not set in.

The surface vessels of the brain are quite congested giving a purple color to the organ. There is marked edema of the membranes. On section no petechial hemorrhages are seen but all vessels are congested. The lungs do not collapse and are quite voluminous. Clear fluid runs from the cut surfaces. The bronchi are filled with white froth. The dependent portions are congested. The heart is not dilated. Beneath the endocardium of the left ventricle are many petechial hemorrhages. The valves, coronaries, and aorta are normal. The liver, kidneys, and spleen are congested.

Anatomical diagnosis.—Marked congestion and edema of the brain; marked edema of the lungs; hemorrhage, subendocardial; congestion of liver, kidneys, and spleen.

Microscopic examination.—Brain membranes show edema and the vessels, even the minute capillaries, are engorged with blood. There is edema of the cortex. None of the sections show any hemorrhage.

Kidney: Marked congestion of all vessels. There is marked cloudy swelling of the tubules in the cortex but no definite degeneration. Some of the glomerular capsules show fibrous thickening, many glomeruli are adherent to the capsule. There is a slight but definite increase of fibrous tissue throughout. Liver shows pronounced diffuse parenchymatous degeneration. The cell outlines are preserved but the cells stain poorly and are filled with granules, yellow pigment, and droplets of varying size. The latter give the chemical reaction of fat. All vessels are engorged with blood. There is moderate lymphocytic infiltration about the interlobular structures.

Lung: The alveoli are distended with fluid and the vessels congested.

Heart: The wall of the left ventricle shows hemorrhage beneath the endocardium. The muscle shows slight brown atrophy.

Microscopical diagnosis.—Edema and congestion of the brain; acute parenchymatous degeneration and congestion of the liver; cloudy swelling, congestion of the kidneys and a mild degree of diffuse nephritis; congestion and edema of the lungs; subendocardial hemorrhage and slight brown atrophy of the heart muscle.

A case, quite similar to the above, occurred at the naval proving grounds, Dahlgren, Va., October 21, 1924, and was reported in the February, 1925, number of the UNITED STATES NAVAL MEDICAL BULLETIN, with quite an exhaustive comment as to the nature of untoward reactions following intravenous administration of arsenical preparations. The entire field is covered quite extensively in this comment and will not be repeated here.

The following remarks are quoted from the complete and carefully considered review of this subject contained in the 1922 report of the Salvarsan Committee of the British Medical Research Council, entitled "Toxic Effects Following the Employment of Arsenobenzol Preparations":

There is a consensus of opinion among those concerned with the treatment of venereal disease that the arsenobenzol preparations are more efficacious than

any other drugs yet available for the cure of syphilis. Although it is true that even these preparations can not be guaranteed to effect absolute cure, except in the earliest stages of the disease, it is now well established that a considerably larger proportion of cures can be effected by salvarsan and its allies than by any other form of treatment.

By absolute cure is meant the complete eradication of the virus of syphilis from the body. To achieve such eradication it is necessary to administer the drug in doses as large as possible without undue risk, and a dosage which is large enough to be adequate, yet not so large as to endanger life or health, except in a very small minority of patients, has been arrived at by the experience of 12 years.

There are, and there will always be, certain exceptional individuals who will react to the drug more severely than others, and in whom a dose, or series of doses, harmless to the average man, may set up dangerous or even fatal complications. The scrupulous physical examination of a patient enjoined upon the practitioner before administration of salvarsan or its substitutes is designed to eliminate cases in which danger might arise, so far as this is possible by human skill and care. But, there will always remain a few individuals in whom, either from congenital intolerance or from the presence of disease which can not be detected, such risk is unavoidable.

There are several untoward reactions following the administration of the arsenical preparations, one of which is the so-called vasomotor phenomena, which occurs quite rapidly after the administration of arsenicals. It is sometimes described as anaphylactic or anaphylactoid, but these terms are not considered advisable to use. The term "nitritoid crisis" has been used by the French to describe this condition. Two types of these immediate reactions have been described by the French writers; the congestive type with redness of the face, and syncopal type with pallor, usually accompanied by abdominal symptoms. The case here being reported would fall under the first classification as the congestion and redness of the face was one of the predominating symptoms, while the latter type characterized the case reported from the naval proving grounds at Dahlgren, Va.

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Editorial comment.—The rapid onset and character of the alarming symptoms which occurred in this case followed by death in less than an hour would seem to suggest that arsphenamine which had not been neutralized had been injected. This premise may be ruled out, however, unless this particular ampule had been wrongly labeled at the laboratory, as it was stated that the labels of all the ampules used during that morning were saved, inspected, and found to be of the same lot number of neoarsphenamine.

The immediate cause of death was undoubtedly edema of the lungs, but the exact cause of the edema can not be definitely stated. However, there are several pertinent facts which were brought out at the autopsy leading one to believe that there was a cumulative action of arsenic on the liver. These facts were (a) macroscopical, congestion of the liver; (b) microscopical, pronounced diffused parenchymatous degeneration, yellow pigmentation, and liver cells filled with fat droplets. This would seem to complete the picture of fatty degeneration due to arsenic. In this connection it is stated in the fifth edition of *Diagnostics and Treatment of Tropical Diseases*, Stitt, 1929, that the practice of relying upon a routine urinalysis for evidence of damage to or deposition of arsenic in the body is an unsafe practice. Before the urine would give sufficient evidence to justify the discontinuance of arsenical medication the liver would be badly damaged. In this work the following procedure is recommended: (1) Before administering arsenic intravenously, perform liver-function test (bromsulphthalein) and urinalysis. (2) After injection, examine urine voided within first 3 to 6 hours for presence of salvarsan, neosalvarsan or atoxyl. (3) It should be kept in mind that the greater number of untoward results occur after the *second* injection and it is at this time that the patient should be kept under observation. (4) Repeat liver-function test at frequent intervals (2 to 3 weeks). (5) Examine urine for salvarsan after each injection and if elimination ceases or is delayed beyond 6 hours discontinue medication. (6) A retention of dye at the end of 30 minutes is a definite indication of damage to the liver and further arsenical medication should be either discontinued or the patient transferred to a hospital for further treatment.

Test (Dickens' modification of Autenrieth's test).—(1) Place 10 cubic centimeters of urine in a test tube. (2) Add 3 drops of hydrochloric acid. (3) Let stand for 5 minutes and add 10 drops of 0.5 per cent sodium nitrite solution, stir and allow to stand for 3 minutes. (4) Prepare 10 per cent resorcinol solution which should be colorless.¹ (5) Place 5 cubic centimeters of this colorless resorcinol solution in a test tube. (6) Add to this 3 cubic centimeters of 20 per cent sodium carbonate solution. (7) Gradually overlay resorcinol solution with the diazotized urine.

Interpretation.—The urine at point of contact turns rose-red in color (ring test) in the presence of salvarsan and neosalvarsan and yellow in presence of atoxyl. Lower portion of contents of test tube is used for control. Mix contents thoroughly and the color should remain.

Time interval.—We have tested many specimens of urine following the administration of neosalvarsan and find that elimination begins within 30 minutes after intravenous injection and practically ceases at the end of 4 hours. Faint traces were found in a few specimens at the expiration of the fifth hour and none after 6 hours had elapsed.

¹ Medicinal resorcinol, on account of its color, can not be used in this test.

The deposition of arsenic in the human body following the administration of organic arsenicals is in the more vascular organs, the liver, spleen, and kidneys, but mainly in the liver. While poisoning by arsenic is manifested by brain lesions (encephalitis lethargica hemorrhagica), little, if any, arsenic is stored in this organ. Contrary to the generally accepted idea, arsenic is not found in the stomach contents of those dying as a result of the intravenous administration of organic compounds of this drug.

It is a reasonable deduction in this case that the liver degeneration found at autopsy did not occur from the last dose of neoarsphenamine but that this degeneration may have been due to damage produced by previous doses. It is also a reasonable deduction that the brown atrophy of the heart muscle was not produced by the last and fatal dose.

According to Stitt—

Untoward results following the administration of the arsphenamines may be roughly stated to be numerically inversely proportionate to the experience of the administrator and his care in the selection of drugs and dosage. They may be enumerated as (1) death on the table, physico-chemical and due most often to imperfectly alkalized arsphenamine; (2) the nitritoid reaction; (3) Herxheimer reaction; (4) nervous relapse (neurorecidive) due probably to the killing of most of the treponemata except those in the difficultly penetrable tissue of brain and cord or to the increased activity of the treponemata; (5) arsenic poisoning—(a) acute yellow atrophy of the liver, (b) encephalitis, (c) exfoliative dermatitis; (6) optic neuritis.

To prevent the administration of arsenicals to patients with a damaged liver it is considered advisable to determine the function of this organ by the use of the van den Bergh test at frequent intervals during treatment.

The clinician should bear in mind that reactions from arsphenamine are immediate while those from neo- and sulpharsphenamine are delayed. Reactions from the latter generally start after 24 to 48 hours and may appear a week after administration due to accumulation of the drug.

In regard to the heart, it may be stated that the evidence at hand indicates that the first dose of an arsphenamine given intravenously may cause a drop in the blood pressure of from 25 to 40 millimeters of mercury. However, the suprarenal gland seems to be able to react favorably to this shock within a few minutes. The ability of the gland to react does not occur following subsequent doses in those patients exhibiting this phenomenon. (Stitt, 1929.) "The drug used to combat the nitritoid reaction is epinephrin and that used with indifferent success to combat the several manifestations of arsenic poisoning is sodium thiosulphate." According to Stitt—

Stokes and McIntyre (1928) state that ephedrine gave relief in certain reactions due to arsphenamine, and that it was beneficial in combating the fall in blood pressure due to this drug. They gave 50 milligrams of ephedrine daily by mouth. Sixty-eight cases were treated and relief obtained in 57.5 per cent.

Of forty patients who were relieved from their symptoms by ephedrine and in whom the drug was then discontinued, 27 showed recurrence of symptoms; 13 did not. It would seem that ephedrine is a useful adjunct to epinephrin in the treatment of patients who have reactions due to arsphenamine. Epinephrin on account of rapidity of action, is probably the best drug for relieving immediate symptoms. The treatment may be continued by ephedrine.

The results of experiments show that ephedrine probably has no cumulative effect but, because of its potency, evidences of a mild transient toxicity either from overdosage or hypersensitiveness of the patient are relatively frequent. The symptoms of overdosage resembling hyperthyroidism as reported by Higgins and observed by the writer are as follows: Depression, weakness, anorexia, nausea, eructation of gas, restlessness or an inability to remain still, insomnia, tachycardia with a sensation described as pounding of the heart, choreiform movements, and a coarse tremor of the hands or an irregular incoordination of the fingers in the extended position.

Bloedorn and Dickens (1928) reported a case of nodal tachycardia with pulsus alternans and heart failure resulting from continued use of ephedrine. The patient had palpitation, free perspiration, marked tremor of fingers, weakness of muscles, and shortness of breath.

The histopathological examination of the brain leads one to believe that this organ was edematous and beginning to show evidence of hemorrhagic inflammatory changes. It is unfortunate that the spinal-fluid pressure was not taken, but it is realized that the time interval between the administration of the drug and death precluded this procedure.

The findings in the kidney seem to support the quotation above from Stitt in regard to the value of routine urinalysis and that the greatest amount of damage occurs in the liver. According to Stokes (1926), the acute vascular reaction known as the nitritoid crisis has been generally regarded as an expression of idiosyncrasy or hypersensitivity to the arsphenamines. The nitritoid crisis is so named from its superficial resemblance to the reaction produced by amyl nitrite and usually develops while the patient is still on the table, but it may occasionally be delayed 10 minutes or more.

To quote from Stokes:

The patient develops a sense of uneasiness, accompanied by a feeling of constriction in the throat which causes him to gulp once or twice and move restlessly. The eyes become suffused, and a blush, sometimes with circumoral pallor, spreads over the face and downward on to the neck. If the injection is continued the reaction rapidly becomes severe, the eyelids and face swollen. Blotches of red and white or a general scarlet suffusion develops, with extension of the acute edema to other parts of the skin. Wheezing respiration and laryngeal stridor appear quickly, and the patient may lose consciousness and become pulseless. From the subjective standpoint the reaction is a terrifying one for the patient, accompanied by a sense of suffocation and impending

death which makes him very loath indeed to repeat the experience. The consequences are rarely serious if the injection be stopped on the first warning sign, but if the reaction is fully developed before it is observed by the operator, it may be so serious as conceivably to cause death in weakened individuals with serious organic lesions. French observers have reported seeing a reaction suggesting a nitritoid crisis several hours after an intramuscular injection of arsphenamine, so that it can not be regarded as peculiar to the intravenous use of the drug. Personally I have never seen anything to suggest one after intramuscular injection. The nitritoid crisis can be distinguished clinically from arsphenamine collapse, but bears a marked resemblance to the earlier stages of reaction to the injection of an imperfectly alkalinized or acid solution of arsphenamine. In the latter, however, the phenomenon is accompanied by agonizing pain in the lower back and the preliminary flush is rapidly displaced by a ghastly pallor, with suspension of both radial pulse and respiration, so that the patient seems dead.

Cause of nitritoid crisis.—The nitritoid crisis has been attributed to a variety of causes. Swift noted early that guinea pigs could be sensitized to a mixture of guinea-pig serum and arsphenamine, and that this sensitization was apparently specific. It was, however, recognized clinically that the nitritoid crisis could follow the first injection of arsphenamine, so that it could not be due to anaphylaxis in the strict sense. Following the work of Bezredka and Strobel, Kopaczewski and Mutermilch, Jobling and Petersen, and Novy and DeKruif, on physical conceptions of the anaphylactic mechanism, it seemed probable for a time that precipitation of the arsphenamine base or of the serum proteins (Danysz, Berman) in the blood stream, by whatever means accomplished, was the exciting agent in the production of an anaphylatoxin that gave rise to the reaction by absorption. Schamberg and his collaborators failed to confirm the observations of Berman on serum precipitation by properly alkalinized solutions, and of Danysz on the precipitation of the arsphenamine base provided the solution was properly alkalinized. Nitritoid reactions, moreover, occur with neoarsphenamine, which is neutral and not precipitated. Wide variations in reaction-producing power were noticed during the early months of the war, when toxic arsphenamine was smuggled in from Germany, and American and Canadian products were as yet imperfect. It was evident at that time that there was a drug or impurity factor which could not be left out of account in explaining the reaction. It was next observed that the dividing of the dose of the injected drug into two parts, a small injected portion being followed after a few minutes to an hour by the larger portion of the dose, had a "vaccinating" effect (Swift, Danysz, Stokes) and made it possible to proceed with the second injection at a normal rate without reaction. It was also found that a rapid rate of injection in the first place was more likely to bring on reaction than a slow rate, and that atropin could be used in doses of 1/50 grain to protect against the reaction as in the case of anaphylactic shock (Stokes).

A very important clinical observation as to the value of adrenalin in controlling and preventing nitritoid crises was made by Milian in 1912 and provided the accepted treatment for the reaction up to the present time. Hirano, following out the idea of possible injury to the suprarenal capsules by arsphenamine as an explanation of the nitritoid crisis, found that changes in the suprarenal cortex do occur, but their actual relation to susceptibility or idiosyncrasy to drugs of this type is as yet not fully worked out. Finally, within the past two years much light has been thrown on the mechanism of the nitritoid crisis by the work of Oliver, Douglas, and Yamada, who have

shown that vascular injury and not true anaphylaxis in the strict sense underlies the reaction. The vascular injury is accomplished by red blood-cell agglutination giving rise to varying degrees of capillary thrombosis. Agglutination is apparently more easily produced by the disodium salt of arsphenamine than the monosodium salt, although the former is the recommended form for administration. Variations in the extent and rapidity of onset of the agglutination and capillary thrombosis are sufficient to explain the clinical difference between the effect of properly prepared arsphenamine in a normal person, of acid arsphenamine in a normal person, and of the properly prepared and administered arsphenamine in abnormal or hypersensitive persons whose red blood cells for some reason or other, may be susceptible of easy agglutination. This explanation also accords with the observed gradual development of idiosyncrasy in patients who have received repeated arsphenamine treatments. It accords with the appearance of idiosyncrasy on the first injection and with the differences in the product of various manufacturers, which may quite conceivably contain an unknown substance or have physical properties which favor the agglutination of red blood cells. It also provides a rational basis for understanding the ill effects of rapid administration, since the agglutinative action is proportional both to dose and to the rate at which the drug is discharged into the blood.

The foregoing explanation undoubtedly accounts for many of the reactions to the arsphenamines which occur in the first 24 hours. That there is, however, a specific hypersensitiveness comparable to the hypersensitiveness observed toward specific proteins remains the conviction of those who have watched the behavior of these drugs in a large number of patients, and who have studied the cutaneous reactions which can be produced in patients that have had exfoliative dermatitis (Stewart and Maynard). In all probability there is, as Swift's work suggests, a sensitiveness to an arsphenamine-protein combination, and while it is not always as highly specific as some of the pollen reactions, it is quite as specific, at times, as some food protein skin sensitization reactions. Klauder has described an asthma which was apparently as specific for arsphenamine as the asthma of certain persons susceptible to horse dander. This specific hypersensitivity must be reckoned with as a factor, albeit an unusual one, in treatment.

Theorizing, one can not escape the impression that this patient died from a failure of the acid-base equilibrium of the blood probably due to a disturbance of the liver function, but it is realized that this theory is as yet unsupportable until more light has been thrown upon this phase of liver activity.

The editor wishes to thank the author for the prompt reporting of this case, as it is by this method that advances may be made in preventing future untoward reactions and death following the injection of organic arsenical compounds.

It would be interesting to know if this patient had received mercury, iodides, or other antisyphilitic medication along with the arsenicals.

Medical officers interested in the subject of prevention of reactions following the injection of arsphenamines will find an instructive report from Berlin in the *Journal of the American Medical Association* of February 9, 1929 (p. 489).

**CAISSON DISEASE RESULTING FROM DISREGARD OF PUBLISHED
INSTRUCTIONS AND ESTABLISHED PRACTICE**

A case of caisson disease which occurred on June 16, 1928, was reported by Lieut. Commander H. F. A. Baske, Medical Corps, United States Navy. The patient, a diver attached to the Pacific coast torpedo station, Keyport, Wash., had been working at a depth of 120 feet for 1 hour and 5 minutes while attempting to recover a torpedo and came to the surface at 3.45 p. m. with only 2 stops of about 1 minute each.

Symptoms of caisson disease described as pains in the chest and left elbow, and numbness of both legs appeared 15 minutes later and the diver stated that he "felt bad." He was immediately placed in a diving suit, lowered to a depth of 70 feet for 12 minutes, decompressed and returned to the surface at 5.20 p. m. It was stated that he felt normal upon being released from the suit and was allowed to return to his home where he remained free from symptoms until bedtime.

The following morning he had pains in the abdomen, back, and left arm, paralysis of both legs, and stated that the last time he had voided urine was at 4 p. m. on the preceding day. He was submerged to a depth of 84 feet at 11.15 a. m., but distress signals were received 9 minutes later and he was brought to the surface with a stop at 20 feet for 3 minutes and at 10 feet for 4 minutes. He was then taken to deeper water and submerged to 144 feet for 17 minutes, brought to 70 feet for 3 minutes and then to 50 feet and decompressed according to the tables in the diving manual, reaching the surface at 3.33 p. m. Pain developed over the region of the bladder which was relieved by the withdrawal of 1,200 cubic centimeters of urine by catheter. The patient was returned to the torpedo station at 4.30 p. m. to await the arrival of a tug with diving equipment from the navy yard, Puget Sound, Wash.

At 6.30 p. m. the tug and the diving crew proceeded with the patient to deep water. At 9.02 p. m. he was submerged to 156 feet, after which the depth was increased 6 feet at a time until 180 feet was reached, and returned to 156 feet at 9.50 p. m. The diver's signals were strong and as he was apparently in good condition he was brought to the decompression stage at 70 feet and decompression started according to standard tables. When a depth of 40 feet was attained, the diver signaled repeatedly to be brought to the surface. He was finally brought to the surface at 10.38 p. m. after an emergency signal had been received and found to be completely exhausted and suffering from cramps in the abdomen and legs. His pulse was 56 per minute, respiration very feeble, and he stated that

he could not continue decompression. He was accordingly returned to the station at 11.15 p. m., put to bed and given stimulation.

By this time it became apparent that treatment by further submergence in a diving suit could not be successfully undertaken. Inquiries were then made to find a recompression chamber. One was finally located at Victoria, B. C., and he was taken there, arriving at 10.30 a. m., June 18, 1928.

He was placed in the recompression chamber at 11.25 a. m., and the air pressure within increased to 45 pounds in 50 minutes. The workingload of the chamber was set at 45 pounds so that greater pressure was not available. At 36 pounds it was reported that the patient felt better, and at 40 pounds was able to move his left leg; at 45 pounds improvement was continuing. Decompression was started at 12.15 p. m. and at 12.25 p. m. it was possible for him to exercise to a slight degree. From this time until the chamber was opened at 4.30 p. m., no further improvement was observed. He was then taken from the chamber feeling weak on account of the heat and suffering with a severe headache. His pulse was 110 and respiration 18 per minute. Stimulants, massage, and an alcohol rub were given, and 1,000 cubic centimeter urine obtained by catheter. It was reported that he rested fairly well during the night.

On the following day the patient felt quite rested and better, but had a slight headache which later disappeared. Permission having been obtained to use 60 pounds pressure, the limit of the tank, the patient was again placed in the recompression chamber and the pressure rapidly increased to 60 pounds. The temperature of the air was lower than on the previous day and as the patient was very comfortable at 60 pounds that pressure was maintained for 45 minutes, then lowered to 45 pounds, and finally to zero excess pressure, according to decompression tables, United States Navy Diving Manual. The patient left the chamber with very little assistance.

The next day, June 20, 1928, he felt much better and voided 200 cubic centimeters of urine voluntarily. At 9.50 a. m. he went into the chamber without assistance and the pressure was raised to 60 pounds. Twenty minutes later it was reduced to 45 pounds and the patient exposed to this pressure for 2 hours. Decompression was then continued and completed at 4.34 p. m., when he left the chamber without assistance. His pulse was then 64 and respiration 16 per minute. Weakness of gradually diminishing intensity, especially of the legs, thighs, and hips, persisted for about six more days followed by complete recovery.

Editorial comment.—The reason for the rapid ascent of this diver after working at a depth of 120 feet for over 1 hour was not stated in the report, but it is apparent that the decompression given was not only in total disregard of the established practice but contrary

to the mandatory instructions contained in the Diving Manual, 1924, United States Navy, issued by the Bureau of Construction and Repair, and prepared jointly by that bureau and the Bureau of Medicine and Surgery. It may be mentioned here that the Bureau of Construction and Repair will furnish every officer in the service with a copy of the diving manual and it is particularly desirable that every medical officer have his own copy.

The diving manual provides that in all diving operations, decompression or ascent in accordance with the printed tables shall be strictly followed, and except in special exigencies no diver shall be brought to the surface faster than the time specified. These tables have been tested and proved safe and have shown that, while they will not always prevent a slight or moderate attack of the bends, a diver decompressed according to them will not develop a serious attack of caisson disease. Furthermore, Mankin (1928) states that with one exception no one engaged in active diving during operations for the salvage of the U. S. S. *S-4*, was incapacitated or prevented from taking his regular turn by reason of illness or injury. The one exception was due to an accident. There were 10 cases of compressed-air illness as a result of the 566 dives made during the salvage operations, but all cases were mild. In three instances the patient had to be recompressed in the chamber twice and in one case three times. Upon reaching the surface the divers were placed in the recompression chamber, the pressure immediately raised to the prescribed amount and then decompressed according to the tables in the manual.

Decompression in the water, which should have been given the diver in the case reported above, includes the following steps and time limits: Forty feet, 10 minutes; 30 feet, 20 minutes; 20 feet, 30 minutes; 10 feet, 35 minutes; or a total time of 97 minutes. Certainly the ascent should not have been more rapid than the table which provides stoppages as follows: Forty feet, 5 minutes; 30 feet, 10 minutes; 20 feet, 15 minutes; 10 feet, 25 minutes; or a total of 55 minutes.

It is noted that when symptoms of caisson disease first appeared the diver was "put in suit and submerged," and when brought to the surface he returned home. The diving manual states that if the diver has been working at great depths or exposed for long periods in the shallower depths, the dress shall not be removed until a period of at least 20 minutes has elapsed. The reason for this is that if symptoms of caisson disease appear the diver can be sent down immediately to his first stop on the decompression stage and again decompressed. If, however, a recompression chamber is ready for immediate use the dress shall be removed as rapidly as possible and the diver kept by the chamber in order that recompression can be promptly applied if symptoms of caisson disease develop. These symptoms, as a rule,

appear within the first hour but may be delayed as long as 15 hours after the ascent. If none become manifest within an hour it is probable that a serious attack will not occur but if any deep diving has been done, it is best to keep the man aboard where he can be observed by some one for at least 8 to 10 hours.

The report states that on June 17 the diver was submerged to 156 feet and the depth increased 6 feet at a time until 180 feet was reached, and that on June 18, when placed in the recompression chamber, the pressure was raised to 45 pounds in 50 minutes. Absorption of nitrogen still takes place at high pressure whether the pressure is being increased or decreased at the time, and a slow increase of the air pressure to a diver in a diving suit or a recompression chamber will cause more nitrogen to be absorbed with a consequent delay in ultimate decompression. Saturation and desaturation of the blood and tissues with nitrogen takes place at the same rate, therefore decompression must be in proportion to the compression and length of exposure to high pressure. In deep diving it is advantageous for the diver to descend rapidly, limit his stay to the shortest possible time, and ascend without delay to the first stage of decompression.

When the recompression chamber is used the pressure should be increased to 45 pounds, with as little delay as possible. According to the diving manual, this pressure in most cases will be sufficient to revive the patient. If, however, the patient does not show decided improvement, the pressure must be further increased to 60 pounds. In one instance, 75 pounds was necessary after a 300-foot dive and in another instance the same pressure for 5 minutes was required to relieve symptoms following a 7-minute dive at 33 feet. In this case, reported in the July, 1927, number of this bulletin, proper recompression was not given until 72 hours had elapsed.

This pressure must be maintained until all indications of circulatory embarrassment or dyspnea have disappeared, and if no other serious symptoms are present, decompression may be started at once. If paralysis has occurred and is not relieved in two hours, it is useless to wait longer at high pressures. It must be remembered that exposure in the chamber to pressures exceeding 30 pounds is likely to prolong decompression unduly.

Decompression, according to the diving manual, should be started as soon as the patient is relieved, pressure being allowed to fall at the following rates:

When pressure in chamber is—	Pressure may be allowed to fall at a rate not faster than—
Above 60 pounds.....	Rapidly.
Between 60 and 45 pounds.....	1 pound in 1 minute.
Between 45 and 30 pounds.....	1 pound in 3 minutes.
Between 30 and 15 pounds.....	1 pound in 5 minutes.
Below 15 pounds.....	1 pound in 10 minutes.

No hard and fast rule can be laid down for a decompression rate which will depend on the condition of the patient, how he stands decompression, and also the pressure at which he was saturated. If the patient becomes ill again while the pressure is falling, decompression must be stopped, and, if necessary, the pressure raised; when the patient is better, pressure may be allowed to fall again, but at a slower rate. If, after decompression, the patient again develops symptoms, the process of recompression and subsequent decompression must be repeated.

LONGEVITY OF TYPHOID BACILLI IN CHEDDAR CHEESE¹

A STUDY FOLLOWING AN OUTBREAK OF TYPHOID FEVER TRACED TO CHEESE

By E. M. WADE, Fellow A. P. H. A., and LEWIS SHERE,² Divisions of Preventable Diseases and Sanitation, State Department of Health, Minneapolis, Minn.

Cheese has been reported very rarely as a factor in the transmission of typhoid fever. The only prior epidemic of typhoid fever traced to Cheddar cheese that we have found is that which occurred in Michigan in 1917, and was reported by E. D. Rich in 1923. In that epidemic there were 51 cases with 4 deaths. Two epidemics of gastroenteritis are reported by Linder, Turner, and Thom, a streptococcus pathogenic for cats being responsible; one was due to imported Albanian cheese and one to American Cheddar cheese.

During February, March, and April of 1925, an epidemic of 29 cases of typhoid fever, with 4 fatalities, was reported from 8 sanitary districts of 4 counties in Minnesota. The first case developed symptoms February 2 and the last April 3.

Epidemiological investigations made by the department showed the source of infection to be cheese made in a cooperative cheese factory on January 11 and January 12. This cheese was noted by the cheesemaker as having what is commonly called "dead curd." The acidity of the milk could not be increased by any of the usual methods, and the result was a very soft cheese. As the creamery had many requests for fresh cheese, this lot was distributed as early as 10 days after making, instead of being held to ripen as is usually done.³

¹ Reprinted from the American Journal of Public Health, Vol. XVIII, No. 12, December, 1928; read before a joint session of the laboratory and food, drugs, and nutrition sections of the American Public Health Association at the fifty-seventh annual meeting at Chicago, Ill., Oct. 15, 1928.

² Resigned.

³ On Apr. 16, 1925, there was obtained from one of the families in which typhoid fever occurred a piece of cheese said to be part of this same lot. At this time, 95 days after manufacture, the cheese was very dry. The acidity was 0.95 per cent and no typhoid bacilli were isolated from it.

The epidemiologist found evidence pointing to a carrier in the family of one of the contributing patrons of the cheese factory. Bacteriological findings confirmed this evidence. *B. typhosus* was isolated from three specimens of feces received from Mrs. B., age 57, who gave a history of having had typhoid fever in 1900.

Cheese known commercially as Cheddar cheese is made from whole fresh milk. At this cooperative factory the following method is used:

The milk is kept at a temperature of 86° F. until the acidity has reached 0.20 per cent. This is hastened by adding commercial starter. When the correct acidity has been reached, coloring matter is added and also rennet (4 to 6 ounces per 100 pounds milk). The milk thus treated is allowed to stand without agitation until the curd is firm, at which time it is cut into small cubes and the temperature gradually raised (1° in each 5 minutes) to 98° F. The cubes of curd are gently but continuously agitated to prevent their adhering to each other, until they have shrunk to half their original size and when squeezed together by hand will not adhere. The whey is then drawn off and the curd stacked to drain with temperature maintained at approximately 98° F. The curd is turned every 15 minutes until the cheddaring process is completed, at which stage it has become a homogeneous mass of a texture like chicken breast, and when held for an instant against a hot iron forms shreds 1 to 1½ inches long. This cheddared curd is then cut up fine; salt is added (35 grams to 100 pounds), the temperature lowered to 80° F., and the curd put into the cheese press. On removal from the press the cheese is dipped in paraffin and stored at about 60° F. to ripen.

Since cheese so seldom has been found to be the source of typhoid epidemics, it was thought desirable to attempt to find out what kills typhoid bacilli in Cheddar cheese, as there seems to be nothing in the heat used or the acidity developed during the process of manufacture which would necessarily destroy these organisms. With this in mind, 18 small cheeses were made following as closely as possible the above method. A galvanized iron pan 15 by 10 inches in a water bath served for a vat, and a cutting implement was improvised from sheet metal.

For each cheese made, 7 quarts of milk were used. This milk was infected, usually the evening preceding the making of the cheese, with 50 cubic centimeters of an 18-hour broth culture of *B. typhosus*. For all the experimental work, the typhoid strain isolated from Mrs. B. was used. The milk was allowed to stand over night either in the icebox or at room temperature, according to the age of the milk, maximum multiplication of the bacteria without curdling being desired. The finished cheeses weighed about three-fourths pound each and were of good consistency.

For the most part, one cheese was made on each of three successive days, using the same lot of milk, which was kept in the refrigerator until needed. Raw milk was used for all except cheeses O, P, R, and

S, for which pasteurized milk was used. Samples for examination for *B. typhosus* were taken at different stages during the process of manufacture, and at frequent intervals afterwards. After sampling the cheese by means of a cork borer, the hole was thoroughly sealed with paraffin. All samples were plated on eight plates of brom cresol purple lactose agar, typical colonies fished, checked for cultural characteristics on broth, milk, dextrose, and saccharose broth, and for agglutinability with known positive serum.

Samples were taken from each cheese during the process of manufacture as follows: (1) Before adding the starter, (2) before adding rennin, (3) as curd was forming, (4) after cutting curd (both whey and curd), (5) on completion of cheddaring (both whey and curd), (6) after salting, and just before placing in press. Samples were taken from the finished cheeses daily, except from cheeses H and K, until three consecutive tests failed to show typhoid bacilli. On cheeses H and K bacteriological tests were made daily for 16 days and then at intervals of 3 or 4 days until the thirty-sixth and thirty-fourth days, respectively.

Tests for acidity were made daily on all but the first seven cheeses. For all acidity tests of cheese, 5 grams were emulsified in a mortar with 100 cubic centimeters hot water; 25 cubic centimeters of filtrate were titrated with N/10 NaOH, using phenolphthalein as indicator. Table 4 gives a summary of the cheese made, the length of time in days that *B. typhosus* was found living in each cheese, and the acidity of the cheese when one day old, and when *B. typhosus* was no longer found. All determinations have not been shown, as they would make the table cumbersome.

In each cheese tested the increase in acidity was gradual and *B. typhosus* was continuously present up to the date of first negative findings, except in the following five instances: In cheeses B, C, and E one examination only failed to show *B. typhosus* before obtaining the three consecutive negative results. In cheese R one colony of *B. typhosus* was obtained on the third day, while *B. typhosus* was not found on the first and second days, and in cheese U typhoid bacilli were recovered on the first and second days, but not on the third to eighth days, inclusive.

With the exception of cheeses H and K the duration of *B. typhosus* ranged from 0 to 8 days, averaging about 4 days. The acidity ranged from 0.61 to 0.83 per cent when 1 day old, to 0.72 to 1.15 per cent at the end of the tests. From cheeses H and K *B. typhosus* was recovered on every test until no more material for testing was left, which was on the thirty-sixth and thirty-fourth days after manufacture, respectively. Cheeses H and K had acidities of 0.67 and 0.47 per cent, respectively, when 1 day old. Cheeses L and P had practically the same degree of acidity as cheese H, yet *B.*

typhosus survived in them but three days and one day, respectively. At the end of the testing cheese H had an acidity of 1.04 per cent and cheese K only 0.72 per cent, and yet *B. typhosus* was surviving in both, while in nine other cheeses in which typhoid bacilli could no longer be found acidities ranged from 0.65 to 1.15 per cent. No difference was noted in the consistency of the cheese in which *B. typhosus* lived the longest and those in which *B. typhosus* was recovered for only a short period or not at all.

TABLE 4.—*Longevity of B. typhosus in 18 experimental cheeses*

Cheese	Date	Milk	Starter	B. typhosus during manufacture	Recovered, number days	Per cent, 24 hours	Acidity, day of first negative
A	Oct. 29, 1925	Raw	Commercial	All specimens	6		
B	Nov. 3, 1925	do	do	do	6		
C	Nov. 4, 1925	do	do	do	7		
D	Nov. 5, 1925	do	do	do	4		
E	Dec. 8, 1925	do	do	do	4		
F	Dec. 9, 1925	do	do	do	2		
G	Dec. 10, 1925	do	do	do	6		
H	Jan. 25, 1926	do	<i>S. lacticus</i>	do	¹ 36	0.67	² 1.04
K	Jan. 27, 1926	do	do	do	¹ 34	.47	² .72
L	Feb. 23, 1926	do	Commercial	do	3	.68	.83
M	Feb. 24, 1926	do	do	do	1	.72	.79
N	Feb. 25, 1926	do	do	do	0	.65	.65
O	Apr. 7, 1926	Pasteurized	do	do	6	.76	1.01
P	Apr. 8, 1926	do	do	do	1	.61	.98
R	June 22, 1926	do	<i>S. lacticus</i>	All except No. 5 whey	3	.72	.86
S	June 23, 1926	do	do	All specimens	3	.81	.90
T	Apr. 7, 1927	Raw	do	All except No. 5 whey and curd	0	.83	.83
U	Apr. 8, 1927	do	do	All specimens	8	.58	1.15

¹ No later tests, cheese all used.² Last day of test, *B. typhosus* still present.

To determine what influence the addition of acid and the cultivation of certain organisms commonly found in milk have on the destruction of typhoid bacilli, the following experiments were undertaken:

Experiment 1.—January 5, 1926, nine flasks of milk, each containing 800 cubic centimeters, were sterilized by steaming one hour on each of three successive days. Acidity of milk after sterilizing was 0.162 per cent. To each of three flasks enough chemically pure lactic acid was added to bring the acidity to 0.22, 0.58, and 0.99 per cent, respectively. To two flasks pure culture of *S. lacticus* was added; one flask was kept at room temperature and one in the icebox. To two other flasks a pure culture of a diplococcus isolated from pasteurized milk was added. (This diplococcus, referred to hereafter as diplococcus X, was an enzyme producer and had been causing sweet curdling of the milk in a large milk plant.) One flask was kept at room temperature and the other in the icebox. The remaining two flasks were used as controls. All nine flasks were inoculated with *B. typhosus*, using for each flask 9 cubic centimeters of an 18-hour

broth culture. From time to time one-half cubic centimeter quantities from each flask were plated on brom cresol purple lactose agar, characteristic colonies fished and verified for *B. typhosus*.

The flask in which the acidity with lactic acid was 0.99 per cent curdled at once and *B. typhosus* was recovered on the second day, but not on the third day or later. From the flask in which the acidity with lactic acid was 0.58 per cent *B. typhosus* was recovered for 37 days. In process of handling, this flask became contaminated and the acidity increased until on the twenty-fourth day it was 0.83 per cent and remained unchanged until the fortieth day, when the testing was discontinued. The flask in which the acidity with lactic acid was 0.22 per cent increased in acidity to 0.45 per cent by the thirteenth day and was 0.56 per cent on the seventy-first day. Tests were made at intervals of four or five days and *B. typhosus* was last recovered 84 days after inoculation. On the following day the acidity was 0.61 per cent.

The flask inoculated with *S. lacticus* and left at room temperature was curdled four days after inoculation, but *B. typhosus* was isolated that day. The next test was made on the seventh day, and no typhoid bacilli were found at that time or on three successive tests made at daily intervals. The acidity on the eighth day was 0.89 per cent. The corresponding flask in the icebox increased in acidity very slowly, reaching 0.40 per cent on the one hundred and fifth day, and *B. typhosus* was recovered 163 days after inoculation, when testing was discontinued.

The flask inoculated with diplococcus *X* and left at room temperature increased in acidity slowly until it reached 0.60 per cent on the thirtieth day and then remained unchanged. *B. typhosus* was isolated 54 days after inoculation, but was not isolated on the fifty-sixth day or later. The corresponding flask kept in the icebox reached an acidity of 0.45 per cent on the seventy-first day after inoculation, at which time *B. typhosus* was isolated. Unfortunately, it was not tested again until the one hundred and fifth day, at which time the acidity was 0.75 per cent and no typhoid bacilli were found.

The control flask inoculated with *B. typhosus* only, and left at room temperature, became infected during handling and the acidity gradually increased until the thirty-fourth day after inoculation, when it was 0.87 per cent. On that day *B. typhosus* was recovered, but on the following day and later no typhoid bacilli were found. In the similar flask kept in the icebox *B. typhosus* was isolated periodically for 163 days after inoculation, at which time tests were discontinued. On the one hundred and fifth day the acidity was 0.52 per cent.

Experiment 2.—A similar set of tests was made on January 18, 1926. Milk was obtained from a certified dairy on January 13:

800 cubic centimeters were placed in each of nine flasks and steamed one hour on each of three successive days. Three flasks were acidified with chemically pure lactic acid to give final acidity of 0.53, 0.71, and 0.93 per cent, respectively, instead of the weaker acid reactions used in the first experiment. Two flasks were inoculated with *S. lactious* and two with diplococcus *X*. The remaining two flasks served as controls. One of each of the last three pairs was kept in the icebox and the other at room temperature. The *S. lactious* and the diplococcus *X* were grown in sterile milk and 10 cubic centimeters inoculated into each of the respective flasks. To each of the nine flasks was added 10 cubic centimeters of an 18-hour broth culture of *B. typhosus*.

The flask of milk made 0.93 per cent acid with lactic acid was tested daily and *B. typhosus* was recovered after two days but not on the third day or later. The milk made 0.71 per cent acid with lactic acid continued to show typhoid bacilli for eight days after inoculation, but no typhoid bacilli were found later. The acidity tested on the sixth and tenth days was 0.70 per cent. The milk acidified to 0.53 per cent with lactic acid remained at that acidity for 22 days. On the twenty-fifth day, the acidity had increased to 0.78 per cent and a growth of small acid-producing colonies appeared on the plates in addition to the typhoid colonies. *B. typhosus* was last isolated 30 days after inoculation, but only five days after acidity rose above 0.53 per cent.

The milk inoculated with *S. lactious* and left at room temperature increased rapidly in acidity, daily readings for the first five days being 0.45, 0.68, 0.77, 0.81, and 0.84 per cent, respectively. *B. typhosus* was isolated daily for five days but not on the sixth day or later. The similar flask of milk kept in the icebox increased slowly in acidity, reaching 0.65 per cent 27 days after inoculation, at which time *B. typhosus* was last isolated. The flask of milk inoculated with diplococcus *X* and left at room temperature increased in acidity slowly at first, reaching 0.55 per cent on the sixteenth day. Then the acidity increased rapidly, to 1.04 per cent, 34 days after inoculation, at which time *B. typhosus* was recovered. On the following day and later no typhoid bacilli were found. The similar flask kept in the icebox increased gradually in acidity, reaching 0.62 per cent on the sixtieth day and 0.88 per cent on the ninetieth day. *B. typhosus* was isolated on the eighty-sixth day after inoculation, but not on the ninety-second day or later.

In the control flask inoculated with *B. typhosus* only and left at room temperature the organisms survived 129 days after inoculation and in the one in the ice box 151 days, when tests were discontinued.

Experiment 3.—Four flasks of milk, sterilized as in the previous experiment, were acidified January 25, 1926, with lactic acid to make the final readings 0.74, 0.78, 0.81, and 0.90 per cent acid, and then inoculated as before with *B. typhosus* and tested daily. *B. typhosus* was recovered after one day only from the milk made 0.90 per cent acid and after four days from each of the other three flasks.

It appears from these three experiments with milk that an acidity of about 0.70 per cent continued for a few days is deleterious to typhoid bacilli, but in one flask of milk in the first experiment, *B. typhosus* survived an acidity of 0.80 per cent for 13 days and in the second experiment an acidity of 0.92 to 1.04 per cent for seven days. In the first case an acid producing organism was growing in the milk and in the second case an enzyme producer had been cultivated along with the typhoid bacilli.

From these tests it seemed probable that the type of bacteria growing in milk or cheese had an influence on the length of life of *B. typhosus*, either through some undetermined chemical change or through the kind of acid produced. Since it was not practicable to test the various flasks of milk and the cheeses for all the acids present, it was decided to test the longevity of *B. typhosus* in the presence of the different acids commonly found in cheese—lactic, butyric, acetic, propionic, and caproic. For this test 16 flasks were prepared each containing 600 cubic centimeters sugar-free broth pH 7.2. It was planned to use one flask for control and three flasks for each acid, sufficient acid to be added to make acidity titrated with N/10 NaOH read 0.70, 0.85, and 1 per cent, respectively. The available supply of propionic and caproic acids was insufficient to procure quite the concentration of acidity desired. After the reactions were adjusted *B. typhosus* was added, using 8 cubic centimeters of an 18-hour broth culture for each flask. Plates and subcultures were made daily until at least two consecutive sterile tests were obtained. The actual titrations and results are given in Table 5.

These tests show a striking difference in the effect of different acids and indicate that caproic acid is much the most detrimental to *B. typhosus*, as this organism does not survive a concentration of 0.70 per cent for one day, whereas it survives acetic acid in a concentration of 0.73 per cent for four days and of 1 per cent for one day.

The shorter life of the typhoid bacilli in broth to which lactic acid is added, than in milk with the same percentage of lactic acid, is probably due to the combination of some of the lactic acid with the casein, there being left only a portion of the total acid free to act upon the organisms, as pointed out by Zae Northup (3) in a study of the influence of the products of lactic acid on *B. typhosus*.

In order to determine the effect of diminution of free access of air on the life of *B. typhosus* in cheese, the following experiment was undertaken:

On April 1, 1926, cheese L, M, and N, which had been made February 23, 24, and 25, respectively, and from which *B. typhosus* no longer could be recovered, were ground in mortars. To 50 grams of each cheese was added 10 cubic centimeters broth culture *B. typhosus*, and the whole emulsified. Instead of putting in presses, these samples were left at room temperature in tumblers, covered with glass Petri plates and tested daily for *B. typhosus*. The samples, of course, became very mouldy but *B. typhosus* was isolated for 16 days from one sample and for 13 days from each of the others. The acidities of the cheeses before emulsifying were 1.15, 1.19, and 1.04 per cent respectively. Table 6 shows the changes in acidity and the bacteriological findings on the daily tests.

TABLE 5.—Comparative bactericidal effect of various acids on *B. typhosus*

Number of days	Lactic, 0.713 per cent	Butyric, 0.705 per cent	Acetic, 0.73 per cent	Propionic, 0.716 per cent	Caproic, 0.70 per cent
1	+	+	+	+	—
2	—	+	+	+	—
3	—	—	+	+	—
4			+	—	
5			—	—	
6			—	—	
Number of days	Lactic, 0.849 per cent	Butyric, 0.856 per cent	Acetic, 0.875 per cent	Propionic, 0.80 per cent	Caproic, 0.80 per cent
1	—	—	+	+	—
2	—	—	+	+	—
3	—		—	+	
4				—	
5				—	
Number of days	Lactic, 1.01 per cent	Butyric, 1.02 per cent	Acetic, 1.00 per cent	Propionic, 0.94 per cent	Caproic, 0.86 per cent
1	—	—	+	+	—
2	—	—	—	—	—
3	—		—	—	

The remainder of cheeses L, M, and N was mixed and emulsified with *B. typhosus* broth culture, using 450 grams of cheese and 100 cubic centimeters of culture. This emulsion was then packed in the cheese press, at which time the acidity was 0.97 per cent, and when removed from press the following morning the cheese mixture was dipped in paraffin. Samples were taken daily by means of a cork borer. *B. typhosus* was recovered for seven days only. At the be-

ginning of the tests the acidity of the mixture was higher for some unexplained reason than that of the individual samples, and the shorter length of life of *B. typhosus* may have been due to the acidity rather than to the partial exclusion of air. However, the sample of cheese L emulsified and left in the tumbler developed an acidity of 1.12 per cent by the ninth day and *B. typhosus* lived for six days thereafter, whereas the acidity of the mixture of the three cheeses at no time exceeded 0.98 per cent. The variation in the type of bacteria multiplying under the two conditions may also have had an influence on the survival of the typhoid bacilli.

This investigation has raised many questions that need further study, both from a chemical and from a bacteriological point of view.

TABLE 6.—*Longevity of B. typhosus in inoculated cheese with and without access of air*

Number of days	Exposed to air						Air excluded; cheeses L, M, N after pressing	
	Cheese L		Cheese M		Cheese N			
	Per cent acid	B. typho-sus	Per cent acid	B. typho-sus	Per cent acid	B. typho-sus	Per cent acid	B. typho-sus
1	0.83	+	0.72	+	0.69	+	0.98	+
2		+		+		+		+
3		+		+		+		+
4	.90	+	.72	+	.76	+		+
5		+		+		+		+
6		+		+		+	+	
7	1.12	+	.94	+	.97	+	+	
8		+		+		+	+	
9		+		+		+	—	
10		+		+		+	—	
11		+		+		+	—	
12		+		+		+		
13		+		+		+		
14		+		—		—		
15		+		—		—		
16		+		—		—		
17		—						
18		—						
19		—						

SUMMARY AND CONCLUSIONS

1. Reference is made to an epidemic of typhoid fever traced to Cheddar cheese made at a factory, one of whose contributing patrons was proved to be a typhoid carrier.
2. The cheese in question had been made from milk which would not curdle satisfactorily. This would indicate an unusual bacterial flora, resulting in a changed chemical condition.
3. The development of cases in the epidemic indicates that *B. typhosus* lived in the cheese approximately 63 days.
4. Eighteen experimental lots of cheese made from milk infected with *B. typhosus* contained the organisms on the day of manufacture.

5. The experimental data indicate that usually, in the ordinary course of ripening, *B. typhosus* can not be recovered from Cheddar cheese after the eighth day. However, 2 of the 18 cheeses harbored *B. typhosus* for 34 and 36 days, respectively.

6. Since the two cheeses in which *B. typhosus* lived 34 and 36 days, respectively, were made from the same lot of milk, it is probable that the longevity of *B. typhosus* in Cheddar cheese is influenced by the bacterial flora of the milk. Two instances in the milk experiments gave comparable results and seem to substantiate the same probability.

7. The experimental data indicates that the degree of acidity and the character of the acid present are important factors in the destruction of *B. typhosus* in cheese. However, a specific acidity will not uniformly result in the destruction of this organism in cheese. This is probably because different acids do not affect the organism to the same degree and also because the bacterial flora of the milk and the complex chemical constituents of cheese may counteract the effect of the acidity differently in different lots of cheese.

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EXPERIMENTAL FOOD POISONING IN WHITE MICE WITH HEAT STABLE PARATYPHOID POISONS¹

By J. C. GEIGER and K. F. MEYER

From the George Williams Hooper Foundation for Medical Research, University of California, San Francisco

A study of human outbreaks of food poisoning indicates that a severely irritant substance, probably produced by representatives of the paratyphoid-enteritidis group and other bacteria when growing on foods rich in protein, exerts its action on the alimentary tract. A number of workers (Savage and White (1), Branham, Robey, and Day (2), and others) have sought for experimental evidence of such an irritant. Most of the experiments were inconclusive or merely suggestive on account of the apparent insensitiveness of the animal in contrast to the human intestinal tube. Following the oral administration of living or dead paratyphoid bacilli a definite pathological reac-

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tion was either absent or unobtrusive; and delayed (5 to 10 to 14 days, Branham and Day) symptoms were produced unless a general infection was eventually set up. However, in this connection it must be recalled that Gartner (3) as early as 1888 observed significant clinical and pathological manifestations in mice fed with meat previously contaminated with *B. enteritidis* and heated for 1 hour at 100° C. A casual perusal of the literature indicates that the experiments of Gartner have never been repeated on a large scale or with strains which have been recently isolated from outbreaks of food poisoning. The toxicity of these organisms is usually tested by parenteral injections of filtrates or boiled cultures and not by systematic feeding experiments (Bahr and Dyssegaard (4)). These considerations suggested a renewed investigation. Although the studies are still in progress a number of interesting observations deserve wider recognition.

Under suitable experimental conditions which will be detailed elsewhere, certain strains of *B. aertrycke* produce after an incubation time of 3 to 4 days at 37° C. a highly potent enterotropic poison. The active principle is present in filtrates in very potent concentrations, in heated whole fluid cultures. It acts both by intraperitoneal injection and by feeding with the aid of a catheter, or when mixed with bread. The production of symptoms and characteristic anatomical changes was practically universal when a particular strain in a special medium was heated for 10 to 60 minutes at 100° C. or subjected to a temperature of 240° for 10 minutes in the autoclave. Administered by catheter, the sterile, heated poison was fatal to mice weighing approximately 20 grams in some instances in 0.05 cubic centimeter and usually in 0.1, 0.2 and 0.5 cubic centimeter amounts. The heated media treated in an identical manner as the cultures are not poisonous.

TABLE 7

Fed 0.5 cubic centimeter of fluid culture of <i>B. aertrycke</i> grown 4 days—then sterilized by—	Number of mice fed	Number of deaths	Elapse of time from feeding to death
1. 10 minutes at 100°.....	5	5	10 to 13 hours.
2. 60 minutes at 100°.....	5	3	3 to 13 hours.
3. Autoclaved 10 minutes at 240°.....	5	5	1 in 7 and 4 in less than 24 hours.

Approximately 30 minutes after oral administration, the mice exhibit a quiet attitude; in from 60 to 180 minutes they may show uneasiness, excitement, and spasms, roughened coat, labored and accelerated respiration. Later, the eyes are closed by a crusty exudate. Shortly before death, which occurs in from 6 to 12 to 24 hours, general weakness is not uncommon and the motionless animals are flattened

out on the bottom of the cage. In approximately 50 per cent of the poisoned animals the anus is soiled with fluid intestinal content or a plug of glassy mucous. On autopsy the distended abdomen is soft, and, on opening, reveals a markedly distended duodenal loop and keenly injected moist but empty coils of the small intestines. The stomach, filled with a small amount of food, is frequently distended by the same bile tinged or some blood streaked mucous which is present in the ballooned duodenal loop. The mucosa is always injected and sometimes covered with petechia and small erosions. Soft or fluid chyme is found in the large intestines; the jejunum and ileum contain as a rule flakes of clear yellowish mucous. The spleen may be slightly enlarged and the liver is hyperæmic. In some instances both pleural cavities contain a blood-tinged or straw-colored fluid (0.2–0.5 cubic centimeter); the lungs are bright red and collapsed. Cultures from the heart blood, spleen, and liver remain sterile, while those from the intestinal content fail to reveal representatives of the paratyphoid group. The distended duodenum, the hyperæmic jejunum and ileum, and the pleural effusion are pathognomonic for experimental food poisoning in white mice. In the experience of the writers, deaths occurring later than 48 hours after feeding are probably due to other causes than the paratyphoid poison which acts primarily on the duodenum and stomach but may extend its reaction down the intestines beyond the duodenum. Rabbits, guinea pigs, and cats fed double lethal mouse doses by weight of the poison may present transitory and indefinite symptoms from which they rapidly recover. Their blood collected two weeks after the feeding of the poison usually agglutinate the paratyphoid bacilli in low dilutions.

Symptoms of food poisoning have been produced in a *Macacus* monkey by feeding 10 cubic centimeters of a potent poison and its blood had an agglutination titre of 1/640 two weeks later.

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A SMALL OUTBREAK OF FOOD POISONING AT CAMPO DE MARTE, MANAGUA, NICARAGUA

An outbreak of food poisoning which occurred at Campo de Marte, Managua, Nicaragua, was reported by Lieut. Commander B. P. Davis, Medical Corps, United States Navy.

The suspected food was beef hash served for breakfast at the general mess on the morning of September 6, 1928. From an epidemiological study it was believed that all foods could be dismissed from consideration as a possible cause of poisoning except the hash, and circumstantial evidence left practically no doubt that this food was responsible.

Approximately 518 men ate breakfast and 23 subsequently had symptoms of poisoning. First symptoms developed in about three and one-half hours and all those affected became ill within six hours after the meal was ingested. It is assumed that all men who were poisoned had eaten hash, although it was not stated. In this connection, however, it is interesting to note that one of the patients had given some of the hash which was served to him to his pet parrot. The parrot developed convulsions several hours later but finally recovered.

The menus for September 5 and September 6, 1928, were as follows:

WEDNESDAY, SEPTEMBER 5

BREAKFAST	DINNER	SUPPER
Cornmeal mush. Fried bacon. Fried potatoes. Scrambled eggs. Bread. Coffee. Milk and sugar.	Bean soup. Broiled ham. Broiled potatoes. Broiled cabbage. Creamed carrots. Creamed peas. Rice custard. Iced cocoa.	Cold sliced corned beef. Cold baked beans. Sliced cheese. Potato salad. Sliced pickles. Lettuce. Bread. Jam. Coffee. Milk and sugar.

THURSDAY, SEPTEMBER 6

BREAKFAST	DINNER	SUPPER
Canned prunes. Fresh beef hash. Fried potatoes. Toast. Butter. Coffee. Milk and sugar.	Barley soup. Broiled beef. Baked potatoes. Brown gravy. Boiled rice. Creamed onions. Creamed peas. Creamed lima beans. Sliced tomatoes. Bread and iced tea.	Beef stew. Lyonnaise potatoes. Creamed navy beans. Baked macaroni and cheese. Pickled beets. Rice custard. Bread. Jam. Coffee. Milk and sugar.

All patients presented practically the same clinical symptoms and all were seen by a medical officer within 30 minutes after the first symptom appeared. The onset was sudden and was accompanied by nausea and epigastric pain which was described as spasmodic in character, but it was stated that there was no intestinal colic or abdominal distention. Each patient vomited several times soon after the onset and had one or two loose bowel movements before catharsis was effective. No pallor, flushing, prostration, fever, ocular symptoms, or skin eruption was observed and there was no chill, headache, muscular soreness, or buccal symptoms. The pulse and respiration

were normal. The remnants of the suspected food had been disposed of and none could be obtained for examination.

The blood pressure was not taken nor were white blood cell counts or urine examinations made. The stools and vomitus of three patients, however, were examined bacteriologically and the *Bacillus enteritidis* isolated and identified in each case.

The beef used in the preparation of the hash was purchased from a local contractor. It was stated that after the animals were slaughtered the meat was immediately chilled and was delivered on the morning of September 5, or 48 hours later. In the afternoon of the same day the meat was boiled, allowed to cool, then ground up and placed in pans which were stored in the refrigerator during the night. The following morning the meat was again cooked and served as creamed hash for breakfast.

The patients, as they reported at the sick bay for treatment, were given gastric lavage with a solution of bicarbonate of soda which was followed by the administration of castor oil. All made a rapid recovery and were ready for duty in less than 24 hours.

Paratyphoid fever is endemic in Nicaragua and it is presumed that other members of the *B. enteritidis*—paratyphoid group—are also present. The short period elapsing between the ingestion of food and the appearance of symptoms together with their transient character in this outbreak would seem to indicate that poisons already formed in the food or arising from disintegrated bacterial cells were the cause of illness rather than the growth of the bacilli in the human body. There is experimental proof that preformed thermostable toxic substances are produced by certain paratyphoid bacilli but according to Jordan (1927) it seems to be true that the thorough cooking of food just before it is served is in some degree a safeguard. While it is possible that the quarters of beef may have been subject to surface contamination before they were delivered or that the animals were sick when they were killed, it is more probable that the meat was contaminated by infected hands during the process of grinding. Of course, contamination by rats or insects is also a possibility. Although it was not stated, it is probable that the ground meat was exposed in the warm galley to a temperature favorable for bacterial growth for an appreciable period of time before it was placed in the refrigerator. After such exposure where a considerable quantity of ground meat is placed in cold storage, many hours probably elapsed before the meat other than at the surface cools down to a temperature that prevents multiplication of paratyphoid bacilli. Phelps (1927) has pointed out that although it has previously been considered quite safe to return meat that has possibly been contaminated to a cold-

storage room, this and other outbreaks of food poisoning which have occurred in the Navy indicate that such a procedure is by no means safe.

In this instance the outbreak of food poisoning was undoubtedly caused by hash, the meat ingredient of which was prepared the day before it was served, contrary to published instructions and established orders; and the meat was contaminated by human or vermin carriers and then exposed to incubation favorable for the production of a sufficient quantity of toxic material to cause the symptoms of mild food poisoning which resulted.

A circular letter from the Secretary of the Navy dated March 6, 1925, to all ships, navy yards, and stations, provides that no hash shall be served unless it is possible to cook and serve it immediately after preparation, and that hash shall not be issued at any time when it is necessary to prepare the ingredients the night before or even several hours before it is to be cooked and served.

A SMALL OUTBREAK OF FOOD POISONING PROBABLY CAUSED BY VEAL STEW ON BOARD THE U. S. S. "PROCYON"

This outbreak, which occurred on August 15, 1928, while the U. S. S. *Procyon* was undergoing annual overhaul at the navy yard, Mare Island, Calif., was reported by Lieut. Comdr. R. W. Wimberly and Lieut. J. R. Whiting, Medical Corps, United States Navy. A total of 15 out of 100 men were affected. Veal stew served at the evening meal on August 14 was the suspected food. The first indications of illness appeared about 12 hours after the stew was eaten, when a member of the crew reported at the sick bay with chills, diarrhea, and nausea. Within a short period of time other members of the crew appeared at the sick bay with similar symptoms, except that they did not have chills, and at about 2.30 p. m. several other men reported for treatment. Nine men were admitted to the sick list and of these five had symptoms sufficiently severe to require transfer to the Naval Hospital. All those affected had eaten veal stew. One man, however, stated that he thought the rice custard had caused his illness as he had not eaten much of the stew.

The menus for August 13 and 14 were as follows:

AUGUST 13, 1928

BREAKFAST	DINNER	SUPPER
Fresh fruit. Creamed minced beef. Fried potatoes. Bread. Butter. Coffee.	Rice and tomato soup. Baked hamburger. Onion gravy. Buttered tinned corn. Mashed potatoes. Combination salad. Fresh fruit. Bread. Coffee.	American chop suey. Steamed rice. Boiled lima beans. Hashed brown potatoes Assorted jam. Bread. Tea.

AUGUST 14, 1928

BREAKFAST	DINNER	SUPPER
Steamed rolled oats. Fresh milk. Scrambled eggs with bacon. Fried potatoes. Bread. Butter. Coffee.	Cream of celery soup. Fried breaded veal cutlets. Spanish gravy. Buttered tinned peas. Boiled green corn. Creamed potatoes. Bread. Butter. Coffee.	Fresh meat stew with baking powder dumplings. Italian spaghetti. Lettuce salad. Baked rice custard. Bread. Butter. Coffee.

In the absence of the medical officer of the U. S. S. *Procyon* on leave, the medical officer having the guard duty was called. He diagnosed the outbreak as food poisoning which he attributed to beef stew. All patients had fever varying from 101° to 103.4° F., pulse from 108 to 126 and severe abdominal pains which were accompanied with diarrhea, nausea, and vomiting. Respiration ranged from 22 to 36 per minute. Headache, location not stated, and muscular soreness were noted in three cases. Prostration was observed in four cases, in one of which it was recorded as severe. Apparently there was no pallor, flushing, skin eruption, buccal, or ocular symptoms. Urinalyses, white blood cell counts and blood pressure readings if made were not recorded.

Regarding the meat, two pieces of veal sides weighing 130 pounds were received on August 13, 1928, from a local supply company. This meat had been inspected and was accompanied by the ship's copy of the certificate of inspection by the Bureau of Animal Industry signed by the inspector. It was also properly inspected after receipt on board. This meat was first used for dinner, and that remaining, for the evening meal on August 14, 1928, in the form of veal stew. There was no evidence of spoilage; the meat was boiled and served while hot.

Doctor Wimberly considered it evident that food served at the evening meal on August 14, 1928, was the cause of the poisoning. No analysis of the suspected food was made, as none was available. The galley in which the food was prepared was located on the dock near the ship and was of the portable type. A sample of the water used on board was examined at the laboratory of the naval hospital and found to be potable. The *B. enteritidis* was isolated in one of the cases transferred to the hospital. It was reported that recovery was prompt and uneventful in all cases.

AN OUTBREAK OF FOOD POISONING ATTRIBUTED TO BAKED BEANS ON BOARD THE U. S. S. "MELVILLE"

By C. I. WOOD, Lieutenant Commander, Medical Corps, United States Navy

A mild epidemic, apparently of food poisoning, occurred on board the U. S. S. *Melville* on October 18, 1928. Of a crew approximating 446 men, 51 were affected. The symptoms exhibited were abdominal

pains, described as cramplike, and diarrhea, which appeared suddenly and simultaneously among those affected, about eight hours after partaking of the evening meal. They were not severe, and only one patient, who presented symptoms neurotic in character rather than those referable to the gastrointestinal tract, required admission to the sick list.

A study of the food and water supply seemed to incriminate baked beans, served with the evening meal October 17, as the most probable causative agent. The beans were prepared with molasses, canned tomatoes, bacon, and a small amount of spices, baked during the previous night, and served as baked beans for breakfast on the morning before the outbreak. The beans left over from breakfast were placed in a large galvanized iron dishpan, allowed to remain in the galley during the day, where atmospheric conditions were favorable for bacterial growth, and served as cold beans for supper that evening. They were thus eaten cold almost 24 hours after they were originally prepared. The menu for the evening meal was as follows: Cold bologna, cold beans, potato salad, lettuce and tomato salad, bread, butter, and cocoa.

At first, bologna sausage, would naturally be the first article of food in the menu to be looked upon with suspicion, but several men developed symptoms who had not eaten any of the bologna, while others who were not affected had eaten bologna but no beans.

The symptoms subsided within a few hours and all the patients, with the exception of the one who was admitted to the sick list for treatment, continued with their regular duties. A specimen of the stool from this case which was examined in the laboratory of the United States Naval Hospital, San Diego, Calif., was positive for a bacillus belonging to the paratyphoid-enteritidis group of microorganisms. While the circumstances seemed to implicate contaminated food rather than the water supply, samples of the drinking water were sent to the laboratory and found to be free of pathogenic bacteria. None of the beans and none of the other articles of food served with them could be obtained for examination. It may be remarked, however, that several of the men stated that the beans did not taste right and were sour, whereas others who partook of them freely stated that they ate them with relish.

The annual report of the surgeon general, United States Navy, 1927, states that, "Most cases of food poisoning in the Navy are due to contamination of food, especially meats and meat products, with microorganisms of the *B. enteritidis*—paratyphoid group of bacilli." The present report does not seem to implicate the meat but does implicate food that had been prepared almost 24 hours previously and had been kept in a warm place where any contamination,

avored by the molasses sugar media, would have fertile soil for breeding.

In view of the above, it is believed that greater care should be exercised and that sufficient food should be prepared for but one meal. If it should become necessary under exceptional circumstances to keep meat, meat products, and certain other foods for a subsequent meal, they should be promptly removed to cold storage in order to inhibit bacterial growth and served before fermentation or other spoilage has had time to occur.

MUSSEL POISONING IN CALIFORNIA¹

By Dr. K. F. MEYER, Consulting Bacteriologist, State Department of Public Health;
Director, Hooper Foundation for Medical Research

During the month of July, 1927, 102 people were seriously poisoned and 6 died following the consumption of the large mussel, *Mytilus californianus*, Conrad, which had been freshly gathered at 14 different beds on the open shore line of the Pacific coast in the vicinity of San Francisco. Although the origin of the poison is not definitely established, since the investigations are still in progress, it is known that (1) the toxic properties of the mollusks are due to a poison, probably a quaternary amine, which is heat stabile in acid solutions and which causes motor nerve paralysis; the concentration of the poison, as determined by laboratory test, may vary in different mussels and different beds; (2) the poison is not formed by bacteria nor due to copper salts from the rocks nor due to the little crab, *Pinnotheres pisum*, which lives in the mantle cavity, nor is it induced by parasites such as sponges and starfish; (3) the poisonous mussels were neither located in the stagnant and polluted basins nor exposed to the sun for a long period at low tide, but they were subjected to the ebb and flow of the tides; the poison is therefore not due to asphyxiation or post-mortem changes; (4) it is probably the result of a metabolism disease influenced by the food and spawning condition of the shellfish; (5) poisonous mussels can not be distinguished from sound mollusks, neither by appearance nor behavior on cooking; occasionally a pungent odor may be noted; the "liver" is always large and dark; (6) the shellfish may become poisonous within a few days and may remain so for several weeks; no assurance can be given that the mussels may not acquire the poisonous properties over night; (7) during the winter months, December to March, the poison disappeared only to reappear late in March; however, the amount of poison which may be present early in spring is not

¹ Reprinted from Weekly Bulletin, July 7, 1928, State of California Department of Public Health.

sufficiently concentrated to cause symptoms on ingestion in an empty stomach; (8) since it is impossible to examine all the mussel beds along the California shore line, it is impossible to establish by laboratory test the absence of poisonous mussels in certain beds and during certain months of the year.

From the experiences thus far collected it is quite apparent that the use of mussels on the California coast during the summer months is always connected with some danger. Near Santa Cruz, poisoning cases have occurred in two successive years; no assurance can be given that this condition may not repeat itself. People who notice a tingling or numbness around the lips and prickly feeling in the finger tips and toes 30 minutes or longer after they have eaten mussels should empty the stomach by an emetic, purge the intestinal tube by brisk laxatives, and call for a physician immediately. All, even mild, cases of mussel poisoning should be promptly reported to the California State Department of Public Health, San Francisco.

SOME PRACTICAL POINTS TO BE OBSERVED IN THE USE OF PARIS GREEN DUSTING MIXTURES

Since Barber and Hayne (1922) announced the excellent results obtained by the use of Paris green in the destruction of anopheline larvæ, this method has been used extensively in some sections of the United States. Breeding in large areas, otherwise difficult to treat, has been successfully controlled by the distribution of Paris-green mixtures from airplanes. In the Philippines good results have been reported following the application of these mixtures to small areas by means of dusters operated by hand.

During the summer of 1926, and again during the summer of 1927, Surg. L. L. Williams, United States Public Health Service, and Lieut. Commander S. S. Cook, Medical Corps, United States Navy, did considerable experimental work with Paris green diluted with powdered soapstone or alberene, distributed from an airplane, as a larvicide at the Marine Barracks, Quantico, Va., and succeeded in controlling the breeding of *Anopheles quadrimaculatus* mosquitoes at that place. They used varying percentages of Paris green and soapstone from as low as 14 per cent Paris green to as high as 50 per cent Paris green by weight.

Their ultimate conclusion was that for airplane distribution 33 per cent Paris green by weight was the most advantageous mixture. With wind velocities below 5 miles per hour the mixture was delivered at between 100 and 150 feet above the breeding area. With higher wind velocities the mixture should be delivered at a lower altitude down to 25 feet above the surface, depending upon the

increased force of the wind. The height must be determined by the pilot of the plane, who can watch the drift of the cloud of dust when he makes the first turn after he has commenced the dusting.

Barber (1921), in his first work with Paris green, made all of his applications by having handfuls or shovelfuls of the mixture with road dust thrown or tossed into the air. He usually worked on comparatively calm days, and, of course, secured a very small drift of the resulting dust cloud. He found that the best mixture was in the proportion of 1 part by weight of Paris green to 99 parts of road dust.

"Since then," Doctor Williams writes, "we have commenced experimentation on the distribution of Paris green from various types of blowers. These experiments are as yet incomplete, but they indicate roughly that with a hand-power blower, such as the Savage or the Niagara hand-power duster, a 15 per cent dilution in either powdered soapstone or in hydrated lime is the safest mixture to use. With a hand-power blower, where the dust cloud may be projected vertically from 10 to 20 feet into the air, a mixture of from 20 to 25 per cent Paris green with either of the above diluents is the most effective."

When using a 15 per cent Paris green mixture with a hand-power duster, he has found from practical application that a good rule-of-thumb method of operation is to walk along the windward side of the area to be dusted, liberating the dust as fast as a laborer can walk comfortably, or to have the laborer rowed in a boat on the windward side close to the shore at about the speed of ordinary comfortable rowing while liberating an adequate dust cloud. The dust will cause the death of anopheline larvæ for at least 100 feet beyond the remotest limits at which the eye can still see the dust cloud in the air. Hand-power dusters usually have a ratchet, which allows regulation of the dust liberation. When a fair breeze carries the dust a long distance, say 200 to 300 yards, then the ratchet should be opened to its widest limit. On nearly calm days, when the cloud does not drift a great distance, the ratchet should be pushed almost to the closing point.

The dust cloud with a hand duster, using a 15 per cent mixture in a moderate breeze, can be counted upon to safely dust a path 200 to 300 yards wide. Laborers dusting ponds will quickly discover that on days with moderate wind velocities the dust cloud has a very tricky habit of blowing in one direction and farther on being caught by a reverse wind eddy and going in an entirely new direction. Under these conditions it is necessary to dust for a short period, sometimes only a few seconds, and then stop and either wait for a new wind eddy or else take up a new position. With shifting

wind currents one is sometimes able to dust an entire pond or a large bight from a single position near the middle.

We know that powdered soapstone and hydrated lime make excellent diluents for Paris green. For hand distribution Fuller's earth, finely ground wood, ground clay, and road dust make good diluents, as some of the other materials are likely to clog up the blower machinery. Powdered soapstone is not as irritating to the eyes as lime, and has proved a most excellent diluent.

Doctor Williams continues: "Occasionally a lot of apparently good Paris green proves to have a very low toxic coefficient for anopheles larvæ. I have had one such lot myself, and Hackett, from Italy, reports other cases. We usually get good Paris green by specifying 'Paris green not over 3 per cent soluble in water and of a fineness so that at least 85 per cent will pass 200-mesh bolting cloth.' I must strongly advise that if possible a specimen of Paris green from the successful bidder be demanded and that it be tested against anopheline larvæ in order to be sure that it has a high toxic value. This can be done very simply by putting a few anopheline larvæ in a pan of clear water and blowing into the atmosphere of the room about one-half gram Paris green. If any of the larvæ are alive at the end of four hours' time, grave doubts should be cast against the toxicity of that specimen of Paris green."

ENDEMIC TYPHUS FEVER IN THE UNITED STATES¹

Recent work by officers of the United States Public Health Service in connection with studies of endemic typhus fever in the United States is of much interest.

The data which are available from morbidity reports, from the literature, and from field investigations give only a bare outline of the occurrence of this typhus-like disease in the United States. So far as information is available, it seems to indicate that the disease is rather sharply limited to the Atlantic seaboard and the nearby Piedmont sections, going as far north as Boston. It is present in nearly all of the seaports from New York southward and has attained widest distribution in Alabama, Georgia, and Florida. On the Gulf coast, while it has been reported from Tampa, Pensacola, Mobile, Galveston, and Houston, there is at present no information regarding its occurrence in Mississippi or in Louisiana. The lower Rio Grande Valley from Laredo to Mercedes constitutes an important focus. On the Pacific coast only Los Angeles has reported a considerable number of cases. While an occasional case has been

¹ Reprinted from Health News-F-5-U. S. Public Health Service, Feb. 5, 1929.

reported from the interior of the country, that section has been for the most part strikingly free.

This limited geographic distribution in the country at large is confirmed by the more intensive study of the disease in the State of Alabama during the past five years. In this State, as has been pointed out previously, the disease is endemic in the towns south and east of Montgomery, but not to the north and west, except for the few cases which have occurred in the Birmingham district. Considering Montgomery as a primary focus, if the disease were transmitted directly from person to person there is an approximately equal chance that during the past five years it would have spread along any of the six railroad lines or the many highways which enter that city. It would then have had a scattered occurrence and become established at random in the near-by cities and towns in all directions.

This has not occurred. The cases have been grouped almost entirely along the Atlantic Coast Line and its small branches running southeast from Montgomery to Savannah and Jacksonville; along the Louisville & Nashville Railroad running south and slightly west to Mobile, and a branch of this road running to Red Level, Andalusia, and into Florida. These cases have not been traceable to direct importation from Montgomery. Their origin is local. They may occur at considerable intervals of time, but there are one or two or more cases each year in these towns without traceable association with a previous case and without subsequent secondary or contact cases. The disease is dependent upon undetermined conditions which are present in these towns and absent from those farther north in the State. So far as the human host is concerned, racial composition, habits of life, sanitary, economic, and social status, there are no significant differences apparent in comparing these towns in the southeastern part of the State with towns farther north. Body lice are almost unknown in Alabama, head lice are found occasionally in school children. The infestation with this parasite is generally below 1 per cent, and the towns of the southeastern section are not different from those in the north and west in this respect. The population is stable, and there is practically no immigration from Europe or from Mexico.

The limitation of this disease geographically does not seem to be explained satisfactorily on the basis of direct person-to-person transfer or through the intermediation of the louse. Some agency other than man and his own parasites would appear to be responsible for the preservation of the virus. This agency, be it insect alone, or an insect which feeds upon some host other than man, must be correspondingly limited in its distribution, or at least its capacity for acting as a vector to man must be so limited.

HEALTH OF THE NAVY

The general admission rate, based on returns for diseases and injuries occurring in October, November, and December, 1928, was 549 per 1,000 per annum, as compared with 540 per 1,000 for the fourth quarter of 1927 and with the median rate for the preceding five years, 529. The corresponding rate for the third quarter 1928 was 641 per 1,000.

The admission rate from disease was 483 per 1,000 which is only slightly greater than the expected rate, 459. The admission rate from accidental injuries, 61 per 1,000, was a little lower. Except when influenced by unusual accidents, this rate varies little from year to year.

The outbreak of influenza, which started in the vicinity of San Francisco, Calif., in October and spread through the greater part of the country, was undoubtedly responsible for the increase of diseases of the respiratory type reported as catarrhal fever by several shore stations in the United States. The United States naval training station, San Diego, Calif., reported 178 cases of catarrhal fever in October, 259 in November, and 158 in December. In addition, 8 cases of influenza occurred in November and 39 in December. The United States Marine Corps base, San Diego, Calif., notified 17 cases of catarrhal fever in November and 91 in December; the United States naval training station, Great Lakes, Ill., 51 cases in October, 313 in November, and 97 in December; the United States naval training station, Newport, R. I., 32 in October, 48 in November, and 46 in December. Outbreaks of this disease also occurred at the United States naval training station, Hampton Roads, Va., and marine barracks, Parris Island, S. C., in December, when 211 and 92 cases respectively were reported. During this month 123 cases reported as influenza occurred at the marine barracks, Quantico, Va. It is interesting to note that the incidence of pneumonia at shore stations in the United States did not exceed expectancy during the quarter.

Cerebrospinal fever was responsible for one admission at the United States naval training station, Newport, R. I., in November and six in December. Two of the latter cases terminated fatally. One case of cerebrospinal fever occurred at the United States naval training station, San Diego, Calif., in November, and in December four patients were admitted with this disease at this station, all of whom died.

The admission rate, all causes, for forces afloat was 459 per 1,000 per annum for the quarter, as compared with 464, the corresponding median experience for the 5 preceding years.

The U. S. S. *Mississippi* reported 72 cases of catarrhal fever in November and 31 in December; the U. S. S. *New Mexico*, 31 in

November and 27 in December; the U. S. S. *California*, 12 in November and 35 in December; and the U. S. S. *Maryland*, 5 in November and 84 in December. In regard to influenza, the U. S. S. *Lexington* reported 241 cases in November and 26 in December; the U. S. S. *Saratoga*, 53 in December; and the U. S. S. *Holland*, 34 in November and 12 in December. Three cases of pneumonia occurred on board the U. S. S. *Lexington* in November.

One case of cerebrospinal fever was reported by the U. S. S. *Denver* in October and another by the U. S. S. *Pennsylvania* in November. Both cases terminated fatally. The U. S. S. *Isabel* reported a case of diphtheria in November, and the U. S. S. *Noa*, a case of scarlet fever in October.

The U. S. S. *Panay* reported one case of typhoid fever in October which was contracted at Chung King, China, and the U. S. S. *Asheville*, one case in November.

The Second Brigade, United States Marines, Managua, Nicaragua, reported 1 case of chicken pox in December which was later recognized as smallpox, 1 case of paratyphoid fever in November, and 1 death from paratyphoid fever in October. In the latter case the disease occurred during the month of September.

TABLE No. 1.—Summary of morbidity in the United States Navy and Marine Corps for the quarter ended December 31, 1928

	Forces afloat	Forces ashore	Marine Corps	Entire Navy
Average strength.....	74,738	40,879	19,236	115,617
All causes:				
Number of admissions.....	8,572	7,290	2,870	15,862
Annual rate per 1,000.....	458.78	713.32	596.80	548.78
Disease only:				
Number of admissions.....	7,505	6,468	2,579	13,973
Annual rate per 1,000.....	401.67	632.89	536.29	483.42
Communicable diseases, exclusive of venereal disease:				
Number of admissions.....	2,848	3,695	1,276	6,543
Annual rate per 1,000.....	152.43	361.65	265.34	226.37
Venereal diseases:				
Number of admissions.....	2,526	853	581	3,379
Annual rate per 1,000.....	135.19	83.46	120.82	116.90
Injuries:				
Number of admissions.....	993	778	259	1,771
Annual rate per 1,000.....	53.15	76.13	53.86	61.27
Poisons:				
Number of admissions.....	74	44	32	118
Annual rate per 1,000.....	3.96	4.31	6.65	4.08

TABLE NO. 2.—Deaths reported, entire Navy, during the quarter ended December 31, 1928

		Navy			Marine Corps		Nurse Corps	Total
		Offi- cers	Mid- ship- men	Men	Offi- cers	Men		
Average strength.....		8,784	1,782	85,329	1,181	18,053	488	115,617
Cause: Diseases								
Primary	Secondary or contributory							
Abscess, brain.....	None.....	1						1
Abscess, peritonsillar.....	Pneumonia, lobar.....			1				1
Alcoholism, acute.....	None.....			1				1
Anemia, pernicious.....	do.....					1		1
Angina pectoris.....				1	1			2
Appendicitis, acute.....	Obstruction, intestinal, from internal causes.....			1				1
Do.....	Peritonitis, general, acute.....	1						1
Appendicitis, chronic.....	do.....			1				1
Arteriosclerosis, general.....	Embolism, cerebral.....				1			1
Bronchiectasis.....	Endocarditis, acute.....			1				1
Carbuncle, right cheek.....	Septicemia.....			1				1
Cellulitis, left little finger.....	do.....					1		1
Cellulitis, left leg.....	do.....	1						1
Cerebrospinal fever.....	None.....			7				7
Diabetes, mellitus.....	do.....			1				1
Dysentery, entamebic.....	Abscess, multiple, liver, lungs, and spleen.....			1				1
Embolism, cerebral.....	None.....			1				1
Encephalitis.....	Nephritis, acute.....			1				1
Endocarditis, acute.....	Phlebitis.....			1				1
Gastroduodenitis.....	Hemorrhage, stomach and duodenum.....			1				1
Bacitritis, acute.....	Pneumonia, broncho.....			1				1
Hemorrhage cerebral.....	None.....	1						1
Hodgkin's disease.....	do.....			1				1
Influenza.....	Pneumonia, broncho.....			4				4
Do.....	Pneumonia, lobar.....			3				3
Jaundice, acute infective.....	None.....					1		1
Malaria.....	do.....			1				1
Do.....	Blackwater fever.....			1				1
Do.....	Dilatation, cardiac, acute.....				1			1
Do.....	Myocarditis, acute.....			1				1
Measles.....	Pneumonia, broncho.....			1				1
Myocarditis, chronic.....	None.....			1				1
Do.....	Pneumonia, broncho.....			1				1
Do.....	Thrombosis, coronary ar- tery.....	1						1
Paratyphoid fever.....	Peritonitis, general, acute.....					1		1
Pneumonia, lobar.....	None.....	1		1				2
Sarcoma, retroperitoneal, lymph nodes.....	do.....			1				1
Syphilis.....	Poisoning, neoarsphena- mine, acute.....			1				1
Do.....	Thrombosis, coronary ar- tery.....			1				1
Tuberculosis, chronic pul- monary.....	None.....			3				3
Do.....	Tuberculosis, acute pul- monary, pneumonic.....			1				1
Do.....	Tuberculosis, intestines.....					1		1
Do.....	Tuberculosis, meninges.....			1				1
Ulcer, duodenum.....	Peritonitis, local, acute.....			1				1
Do.....	Peritonitis, general, acute.....			1				1
Ulcer, stomach.....	Pneumonia, broncho.....			1				1
Valvular heart disease, aortic insufficiency.....	Dilatation, cardiac, acute.....			1				1
Total for diseases.....		6		48	3	5		62

TABLE NO. 2.—Deaths reported, entire Navy, during the quarter ended December 31, 1928—Continued

		Navy			Marine Corps		Nurse Corps	Total
		Off- cers	Mid- ship- men	Men	Off- cers	Men		
Average strength.....		8,784	1,782	85,329	1,181	18,053	488	115,617
Cause: Injuries and poisonings								
Primary	Secondary or contributory							
Asphyxiation (illuminating gas).....	None.....					1		1
Burns, multiple.....	do.....	1						1
Cold, effects of.....	do.....			1				1
Crush, pelvis (turret).....	Pneumonia, broncho-.....			1				1
Crush, thorax (motor launch).....	Hemothorax.....			1				1
Drowning.....	None.....			8		5		13
Electric shock.....	do.....			1				1
Fracture, compound, skull.....	do.....			4		2		6
Do.....	Meningitis, cerebrospinal.....			1				1
Fracture, compound, right tibia and fibula.....	Septicemia.....			1				1
Landplane crash: Fracture, compound, skull.....	None.....	1		1				2
Fracture, simple, skull.....	do.....			1				1
Do.....	Hemorrhage, traumatic, intracranial.....			2				2
Do.....	Hemorrhage, traumatic external.....					1		1
Injuries, multiple extreme.....	None.....	2		4				6
Do.....	Pneumonia, lobar.....			1				1
Landplane crash: Injuries, multiple extreme.....	None.....	2		1	1			4
Ittraspinal injury.....	do.....			1				1
Rupture, traumatic, right kidney.....	Hemorrhage, traumatic retroperitoneal.....			1				1
Strangulation, hanging.....	None.....			1				1
Wound, gunshot, brain.....	do.....					1		1
Wound, incised, neck.....	do.....			1				1
Wound, penetrating brain.....	do.....	1		1		4		6
Wound, penetrating abdomen.....	do.....	1						1
Wound, penetrating neck and side.....	do.....			1				1
Wound, penetrating right shoulder and right thorax.....	do.....			1				1
Poisoning, strychnine.....	None.....					1		1
Total for injuries and poisonings.....		8		35	1	15		59
Grand total.....		14		83	4	20		121
Annual death rate per 1,000:								
All causes.....		6.38		3.89	13.55	4.43		4.19
Disease only.....		2.73		2.25	10.16	1.11		2.15
Drowning.....				.38		1.11		.45
Injuries.....		3.64		1.26	3.39	1.99		1.66
Poisoning.....						.22		.03

STATISTICS RELATIVE TO MENTAL AND PHYSICAL QUALIFICATIONS OF RECRUITS

The following tables were constructed with figures taken from monthly reports submitted by naval training stations:

Cumulative data

Jan. 1 to Dec. 31, 1927	Number	Per cent of recruits received	Per cent of recruits reviewed
All naval training stations:			
Recruits received during the period.....	21,323		
Recruits appearing before Board of Medical Survey.....	937	4.39	
Recruits recommended for discharge from the service.....	554	2.60	59.12
September, October, and November, 1928			
United States naval training station, Hampton Roads, Va.:			
Recruits received during the period.....	510		
Recruits appearing before Board of Medical Survey.....	14	2.75	
Recruits recommended for discharge from the service.....	14	2.75	100.00
United States naval training station, Great Lakes, Ill.:			
Recruits received during the period.....	1,195		
Recruits appearing before Board of Medical Survey.....	41	3.43	
Recruits recommended for discharge from the service.....	38	3.18	92.68
United States naval training station, San Diego, Calif.:			
Recruits received during the period.....	858		
Recruits appearing before Board of Medical Survey.....	16	1.86	
Recruits recommended for discharge from the service.....	16	1.86	100.00
United States naval training station, Newport, R. I.:			
Recruits received during the period.....	995		
Recruits appearing before Board of Medical Survey.....	87	8.74	
Recruits recommended for discharge from the service.....	18	1.81	20.69

The following cases, selected from reports of medical survey recently received by the bureau, are presented to indicate conditions existing prior to enlistment which led to early separation from the service. These conditions were so evident that the men should have been rejected at their respective recruiting stations:

Otitis media, chronic.—Apprentice seaman, enlisted Detroit, Mich., October 18, 1928. History of "ear trouble" with discharge from right ear for past three years. Upon reexamination, a large perforation was found in the right tympanum. In the left ear there was a large calcareous deposit on the drum membrane, which was retracted. Depressed arches and scabies were also noted in this case. Surveyed October 22, 1928.

Apprentice seaman, enlisted Indianapolis, Ind., January 16, 1929. History of "ear trouble" during childhood following measles. Examination at a naval training station showed right ear drum thickened and retracted and the external canal filled with pus having a foul odor. Although it was not stated, it is assumed that there was a perforation of the drum membrane. Hearing, whispered voice, right ear 5/15. Surveyed January 18, 1929.

Visual defects.—Apprentice seaman, enlisted at Newark, N. J., February 6, 1929. When examined at a naval training station,

myopia was detected with a visual acuity of 8/20 in each eye. There was a bilateral conjunctivitis, and it was noted that the patient had to squint to see objects only a short distance away. A chronic specific urethritis was an additional defect. Surveyed February 9, 1929.

Dental defects.—Apprentice seaman, enlisted Buffalo, N. Y., February 6, 1929. Dental examination at a naval training station revealed the following: Number of sound teeth, 12; missing teeth, numbers 1, 15, 16, 17, 30, and 32; carious teeth, numbers 2, 3, 4, 5, 7, 8, 9, 12, 13, 14, 18, 19, 20, and 31; exodontia indicated in teeth, numbers 3, 4, 14, and 19. Surveyed February 9, 1929.

Apprentice seaman, enlisted at Buffalo, N. Y., February 6, 1929. Only 11 sound teeth could be found upon reexamination. Teeth, numbers 1, 19, and 30 were missing, and numbers 2, 3, 4, 5, 12, 13, 14, 15, 17, 18, 20, 21, 28, 29, and 31 were carious. In addition, exodontia was indicated in numbers 4, 14, 20, 28, 29, and 31, and probable pulp involvement in others. He was also surveyed February 9, 1929.

Deformity.—Apprentice seaman, enlisted New Orleans, La., November 13, 1928. The history indicates that he sustained a fracture of the right radius five years ago while cranking an automobile. Deformity of wrist with pain and weakness resulted. The findings which were confirmed by X-ray examination were as follows: Some inward boring and shortening of the radius with a dislocation inward of the lower end of the ulna causing outward displacement of the hand. Deformity more pronounced with the hand in dorsi-flexion. Palmar flexion decidedly limited. No notation of the deformity was entered in the health record at time of enlistment. Surveyed December 11, 1928.

Apprentice seaman, enlisted Philadelphia, Pa., February 6, 1929. Reexamination disclosed a marked scoliosis of the dorsal spine to the left. The right shoulder was about two inches lower than the left. Surveyed February 9, 1929.

Apprentice seaman, enlisted Des Moines, Iowa, January 3, 1929. He received a gunshot wound of the right leg in September, 1927, while hunting. The muscles of the upper part of the leg were severed. A contracture of the right soleus muscle resulted. It was stated that he walks with a limp and is unable to raise himself up on his toes. Surveyed February 1, 1929.

Apprentice seaman, enlisted Philadelphia, Pa., February 1, 1929. History of "foot trouble" with pains in both feet and calves of legs for past four months. Examination revealed a pronounced degree of flat foot with *eversion* which placed the weight bearing function on the inner aspect of the feet. The longitudinal arch was nearly obliterated. Surveyed February 5, 1929.

Hernia.—Apprentice seaman, enlisted Los Angeles, Calif., November 9, 1928. Reexamination at a naval training station disclosed an

undescended left testicle and a congenital left hernia. Surveyed November 13, 1928.

Diseases of the skin.—Apprentice seaman, enlisted Birmingham, Ala., January 11, 1929. History of chronic skin disease, exfoliative dermatitis, since early childhood, aggravated during the winter months. Perspiration caused itching. Examination revealed a very dry skin, and a dry dermatitis with marked scaling but without areas of acute inflammatory reaction, involving the face, back, and both extremities. Surveyed January 11, 1929.

Apprentice seaman, enlisted Newark, N. J., February 4, 1929. History and symptoms similar to the above case except that there were papules on the arms and legs which resembled the lesions of psoriasis. The disease appeared to be chronic and intractable to treatment. Surveyed February 8, 1929.

Apprentice seaman, enlisted Newark, N. Y., February 1, 1929. Examination showed lesions of eczema which appeared to be very chronic, on the back and on the anterior surfaces of the thighs. Surveyed February 5, 1929.

Tuberculosis, epididymis and testicle.—Apprentice seaman, enlisted San Francisco, Calif., October 10, 1928. History of injury 15 months before. When reexamined he was found to have a discharging sinus of the scrotum. The right epididymis and testicle were enlarged and indurated with nodules extending up the cord. Nodules were also detected in the prostate gland. The overlying skin was retracted and adherent to the tumor. No active tubercular process was found in the lungs. Smears from the sinus were negative for acid fast bacilli. It was stated that his general health was good and that his weight was 163 pounds. Surveyed October 17, 1928.

Chronic nephritis.—Apprentice seaman, enlisted St. Louis, Mo., January 2, 1929. History of many attacks of acute tonsillitis during childhood. Reexamination at a naval training station showed the presence of a large amount of albumin with many hyaline and granular casts in the urine. Observation and treatment, including rest in bed for one week, extending over a period of 23 days, with a daily examination of the urine, showed no improvement. The blood pressure was 130/80. Surveyed February 1, 1929.

Valvular heart disease, mitral insufficiency.—Apprentice seaman, enlisted San Francisco, Calif., November 2, 1928. History of numerous attacks of acute tonsillitis since childhood. Tachycardia and a systolic heart murmur were found upon examination at a naval training station five days later, and upon reexamination at intervals following. The pulse was as follows: Recumbent, 120; standing, 140 to 160 per minute. Upon the slightest exertion the patient became faint and a gallop rhythm of the heart was observed. The murmur occurred late in systole and was soft in character. Apex beat dis-

placed slightly downward and outward. X-ray examination showed the lateral diameter of the heart to be 50 per cent of the width of the chest. An electrocardiogram recorded the rate as 100 beats per minute. There was a slurring of the R and S waves at the peak, in leads Nos. 1 and 2, and a tendency to right ventricular predominance. Blood pressure was 110/70. Surveyed November 19, 1928.

Functional cardiac disorder.—Apprentice seaman, enlisted Raleigh, N. C., January 4, 1929. Chief symptom, weakness. "The patient is easily tired and slight exertion causes dyspnea." Examination disclosed defective physical development, 15 pounds underweight, tachycardia with pulse rate of 130 per minute, and slight to moderate thyroid enlargement. Hyperthyroidism was suspected. Surveyed January 9, 1929.

ADMISSIONS FOR INJURIES AND POISONING, FOURTH QUARTER, 1928

The following table, indicating the frequency of occurrence of accidental injuries and poisonings in the Navy during the fourth quarter, 1928, is based upon all Form F cards covering admissions in those months which have reached the bureau:

	Admissions, October, November, and December, 1928	Admission rate per 100,000 per annum	Admission rate per 100,000, year 1927
Injuries:			
Connected with work or drill.....	799	2,764	2,913
Occurring within command but not associated with work.....	613	2,121	1,821
Incurred on leave or liberty or while absent without leave.....	359	1,242	1,097
All injuries.....	1,771	6,127	5,831
Poisoning:			
Industrial poisoning.....	6	21	37
Occurring within command but not connected with work.....	94	325	104
Associated with leave, liberty, or absence without leave.....	18	62	35
Poisoning, all forms.....	118	408	176
Total injuries and poisoning.....	1,889	6,535	6,007

Percentage relationships

	Occurring within command				Occurring outside command— Leave, liberty, or A. W. O. L.	
	Connected with the performance of work, drill, etc.		Not connected with work or prescribed duty			
	October, November, and December, 1928	Year 1927	October, November, and December, 1928	Year 1927	October, November, and December, 1928	Year 1927
Per cent of all injuries.....	45.1	20.0	34.6	31.2	20.3	18.8
Per cent of poisonings.....	5.1	21.2	79.7	59.1	15.2	19.7
Per cent of total admissions, injury and poisoning titles.....	42.6	49.1	37.4	32.1	20.0	18.8

Poisoning by a narcotic drug or by ethyl alcohol is recorded under the title "Drug addiction," or "Alcoholism," as the case may be. Such cases are not included in the above figures.

The following cases, selected from October, November, and December, 1928, reports, are worthy of notice from the standpoint of accident prevention:

Hatch cover hazards.—A hatch cover, which had been improperly secured, fell, striking a storekeeper, first class, who was passing through the hatch. He received a contusion of a foot and spent 10 days on the sick list.

While on his way to a handling room during battle-station drill, a midshipman of the third class entered a G. S. K. storeroom by mistake. He fell down a ladder through an unguarded open hatch due to the "negligence of others" and sustained a simple fracture of the left humerus. Loss of time, 63 days in a hospital.

A coxswain, who was descending a hatch, received a lacerated wound of the head when the motion of the ship at sea caused an improperly secured wooden hatch grating to fall. He was treated without loss of time. This case was reported, however as "negligence not apparent."

Gasoline hazards.—Cleaning fluid said to contain gasoline had been used in cleansing the deck of a crew's washroom on board a ship. A seaman, first class, received burns of the hands and face when the excess fluid became ignited by a carelessly thrown cigarette. This accident was reported as due to the "negligence of others." Loss of time, 21 days. The Manual of Engineering Instructions, 1926, chapter 38, paragraphs 38-96, provides as follows: "Gasoline and other volatile liquids which give off inflammable, asphyxiating, or otherwise dangerous fumes shall not be used in confined or inclosed spaces in such a manner as to be dangerous to personnel or matériel."

The following accident resulted from disregard of instructions, Bureau of Construction and Repair, Section VIII, articles 3237 and 3238: An engineman, first class, with approximately 11 years' service, had just finished filling the gasoline tank of an admiral's barge and had inadvertently flooded the carburetor, which it became necessary to drain in attempting to start the engine. A spark from an unknown source ignited the gasoline fumes, and it was reported that both the carburetor and the engine exploded. He received second degree burns of the face, neck, both arms, hands, and legs. Symptoms of broncho-pneumonia appeared seven days later, and the urine contained albumin, casts, and red blood cells. Pulmonary edema developed, and he died the following day.

Firearms, careless handling of.—A second lieutenant of the Marine Corps, through his own negligence, accidentally discharged a .25-caliber pistol while examining the weapon. He received a

punctured wound of the abdomen. Loss of time, 238 days, 200 of which were spent in a hospital.

A sailmaker's mate, first class, while cleaning a revolver which was his personal property and which he had brought on board ship without permission from proper authority, accidentally discharged it. He received a wound of the left hand. Loss of time, 6 days.

Unsafe practice—lack of eye protection.—While a private marine was working at a lathe without wearing goggles, a chip of steel became lodged in the cornea of his left eye. It was stated that "goggles or other protective devices are not available here." This case was reported as "negligence not apparent." Loss of time, 2 days.

Because of his own personal negligence in not wearing goggles, which were provided, an aviation machinist's mate (ground) received an injury to an eye from a flying particle of dust while operating an emery wheel. Loss of time, 3 days.

A flying particle became imbedded in the left eye of a seaman, first class, who was chipping paint with a hand tool (hammer) without wearing goggles. This case was reported as "negligence not apparent, lack of safety device (goggles)." Loss of time, 3 days.

Hot water and steam.—Due to the negligence of others, live steam was turned into the bilges where a fireman, first class, was at work. He received burns of the right side, right arm, and both knees. Loss of time, 22 days.

Responsibility in this case rests with a compartment cleaner for leaving a bucket of hot water directly under a ladder. A chief machinist's mate who was descending the ladder accidentally stepped into the bucket. He received burns of the exposed foot. Loss of time, 13 days.

Unsafe practice—aeroplane propeller.—A seaman, second class (ground), through carelessness undoubtedly prompted by curiosity, placed his hand in contact with a blade of a revolving aeroplane propeller. Result, lacerated wounds of the thumb and index finger. Loss of time, 8 days.

Unsafe practice—acetylene gas.—A ship fitter, first class, was overcome by fumes while welding galvanized metal with an oxy-acetylene torch in a confined space. Loss of time, 10 days.

Defective material—broken board.—Through no negligence of his own, a private marine caught his foot in a broken board in a sidewalk at Quantico, Va. He suffered a sprain of his right ankle. Loss of time, 49 days.



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THE MEDICAL DEPARTMENT OF THE NAVY



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MEDICAL CORPS, U. S. NAVY



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This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

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PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April, 1907, as means of supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to the naval medical officer, reports from various sources, historical essays, notes and comments on topics of medical interest, and reviews or notices of the latest published medical books.

The bureau extends an invitation to all medical officers to prepare and forward, with a view to publication, contributions on subjects of interest to naval medical officers.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of commendation to authors of papers of outstanding merit and will recommend that copies of such letters be made a part of the official records of the officers concerned.

The bureau does not necessarily undertake to indorse all views or opinions which may be expressed in the pages of this publication.

C. E. RIGGS,
Surgeon General United States Navy.

NOTICE TO SERVICE CONTRIBUTORS

Contributions to the BULLETIN should be typewritten, *double spaced*, on plain paper, and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication. For example, addresses, dates, etc., not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in headings and captions, and the editor can be spared much time and trouble, and unnecessary changes in manuscript can be obviated, if authors will follow in these particulars the practice of recent issues.

The greatest accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible for the editor to understand or verify references, quotations, etc. The frequency of gross errors in orthography in many contributions is conclusive evidence that authors often fail to read over their manuscripts after they have been typewritten.

Contributions must be received two months prior to the date of the issue for which they are intended.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustrations, if not original, should be accompanied by a reference to the source and a statement as to whether or not reproduction has been authorized.

The BULLETIN intends to print *only original articles, translations, in whole or in part, reviews, and reports and notices of Government or departmental activities, official announcements, etc.* All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere without an understanding to that effect.

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SPECIAL ARTICLES

PATHOLOGY IN THE TROPICS

A STUDY BASED ON THE REVIEW OF 700 CONSECUTIVE AUTOPSIES IN HAITI

By R. M. CHOISSEUR, Lieutenant Commander, Medical Corps, United States Navy

INTRODUCTION

It has been my privilege for the past three years to be stationed in the Tropics as pathologist to the Haitian General Hospital, Port au Prince, Haiti. During this time a vast amount of pathological material, both of a tropical nature and otherwise, has been presented in the laboratories. An unusual opportunity has therefore been available to study disease in Haiti and to compile statistics based on pathological observations.

In reviewing this series of necropsies as a whole we find very interesting data, particularly as regards the prevalence of disease in Haiti and also as pertains to the most common cause of death amongst the Haitians. It is for that reason that a review of the first 700 necropsies is here presented. The writer appreciates the fallacy of drawing definite conclusions concerning the morbidity of any country from a small series of autopsies alone. Nevertheless, it is believed that these findings are fairly representative of the morbidity rate of Haiti and that this report will be of value in serving as a nucleus for future studies of this nature.

Before beginning a detailed discussion of the subject it will not be amiss to mention a few salient facts regarding the Haitian General Hospital at Port au Prince, where the bulk of this work was done. A brief knowledge of the conditions as they exist here are essential in order that one may properly evaluate the results.

The Haitian General Hospital is under the control of the Service d'Hygiene and has a capacity of 400 beds. The staff consists of 6 naval medical officers, 1 chief pharmacist mate, 1 pharmacist mate first class, 8 Haitian physicians, 10 Haitian internes, 14 Catholic sisters, 3 American Red Cross nurses, and 20 graduate Haitian nurses. The Service d'Hygiene also maintains nine other hospitals

in Haiti, which are located in the more important cities of the Republic; however, the hospital at Port au Prince, being centrally located, is most ideal, from the standpoint of service. Haitians are admitted daily from all over the island, and a report of the diseases presented here should consequently be a fair index to what is common to the entire country.

Haiti is known throughout the world as a veritable hotbed for yaws and syphilis, and it was fully expected at the beginning of this work to find the mortality rate from these diseases leading all others. To my surprise such was not the case. It is true that full 90 per cent of the bodies at autopsy showed evidence of treponematoses in the arterial system, although, as a direct cause of death, yaws and syphilis ranked comparatively low.

DISEASES OF THE RESPIRATORY SYSTEM

In March, 1928, the author read a paper before the Haitian Medical Society at Port au Prince in which a review was made of our first 300 autopsies. This report showed that 31.6 per cent of the deaths were due at that time to pulmonary tuberculosis. The death rate from this disease still leads all others by a large margin, although a decline was noted to 26 per cent when the ratio was taken for 700 necropsies. This decline in the death rate due to tuberculosis indicates two things: First, the standard of living in Haiti is now on a higher scale, due to better sanitary conditions, wages, etc., and, second, the fallacy of basing conclusions on too small a series of cases. There can be no doubt but that pulmonary tuberculosis is the one big cause of death in Haiti. This is evidenced by the fact that on an average of 25 to 30 per cent of the deaths amongst the Haitians are due to this disease. Should this high mortality rate at any hospital result from some acute condition, such as diphtheria, typhoid, malaria, or a host of others, great anxiety would be felt and immediate steps would be taken for their control, but it is not apparently so with tuberculosis. The fact, however, remains that death from tuberculosis deprives the country of a citizen and the party in question is just as dead as though he succumbed to yellow fever, plague, or dysentery.

It is well known that the colored race has practically no immunity to tuberculosis, and once the disease becomes established it apparently goes unchecked and terminates fatally within a few months. During my three years in Haiti I have yet to see a case of arrested pulmonary tuberculosis in a pure-blooded Haitian.

A large majority of the cases of pulmonary tuberculosis occur here between the ages of 20 and 30 years, although no age seems to be immune. Our youngest case was an infant of 1 year, and showed at

necropsy extensive ulcerative lesions of both lungs and of the mediastinum. These organs were removed en masse. (Fig. 1.) Our oldest case was a woman who claimed to be over 100 years old. She presented a large cavity of the upper left lung (fig. 2), with miliary tuberculous nodules of the abdominal viscera.

The cases of tuberculosis that enter the hospital are as a rule fairly well developed and complain of a relatively short illness, one to two months. They have weakness, fever, dyspnœa, and a productive cough. During the few subsequent months of hospitalization they fade rapidly and succumb to the ravages of the disease.

The necropsy findings in all cases are quite similar and fall into three well-defined groups. The most common of these is ulceration and cavity formation of both lungs, with extensive miliary lesions of all organs. In this group the lungs are almost completely destroyed, and present a rat-eaten appearance. (Fig. 3.) Occasionally they appear as almost gelatinous masses, with the bronchi and arteries simply suspended in a necrotic cavity. These cases frequently terminate suddenly with hemorrhage or the bronchi rupture and the entire respiratory system becomes filled with pus.

Group 2 presents a pathological picture quite similar to the above, with the exception that the entire process is limited to the thorax. The abdominal viscera in this group are spared so far as the gross appearance is concerned. In two cases only the mediastinum was involved, with extensive exudative destruction of the hilus glands and involvement of the pericardium. In one of these cases necropsy showed the mediastinum completely filled by the heart and pericardium. The lungs were clear of tuberculous lesions and no nodules were found in the abdominal viscera. The heart and pericardium were removed en masse. Longitudinal sections showed the pericardium much thickened and an organized tuberculous exudate 4 centimeters thick within the pericardial cavity. (Fig. 4.) Case 2 of this series was similar to the above, although the necropsy findings were not so marked.

In Group 3 only small cavities are found in the lungs; however, the entire viscera both above and below the diaphragm are literally filled with small miliary tubercles. The lungs and spleen in such cases show the most involvement.

Two cases of tuberculosis failed to come under the above classification. Here the lesions were of a miliary nature and involved the stomach, intestines, abdominal lymph nodes, spleen, liver, and kidney, with no lesions of any nature above the diaphragm. The primary focus of infection was probably of intestinal origin and the disease for some reason remained confined to the abdomen.

It will be seen from the above that the cases of pulmonary tuberculosis encountered here are of the acute fulminating type and usually

run the course in a short period of from five to six months. Regardless of this fact it is interesting to note the apparent resistance of some patients, even though in the last stages of the disease. As an example, the body of a fairly well-developed man was brought in by the police, having been found on the outskirts of the city, where some men had been hunting the afternoon before. The face was covered with blood and the clothing was saturated. It was believed by the authorities that this man had been shot. Autopsy, however, showed an ulcerative pulmonary tuberculosis with large cavity formations in both lungs and a ruptured pulmonary artery. No evidence of gunshot wounds or violence was found.

In the respiratory series the next most common cause of death amongst the Haitians is lobar pneumonia. Our records show a total of 55, or 8 per cent, of the deaths resulted from this disease. A few cases of broncho-pneumonia were also found among the children, although the great majority of pneumonias in general were of the lobar type. These cases all presented a very similar picture, with complete consolidation of one or both lungs.

We also had one death as a result of carcinoma of the larynx and another from stricture of the larynx in a case of tertiary yaws.

THE GASTRO-INTESTINAL SYSTEM AND HELMINTHIASIS

Diseases of the gastro-intestinal system were responsible for deaths in 33, or 4.7 per cent, of the cases which came to necropsy. Of this number, 13, or 36 per cent, of the total were due to typhoid. Practically all of these cases occurred in young adults and were of the severest type. In each instance the intestines were extensively ulcerated and showed perforation in four cases, which resulted in peritonitis.

One interesting point regarding typhoid is that 10 cases occurred in 1927, while we had only 3 in 1928. This may be attributed to two definite reasons: During 1927 the water supply of Port au Prince was heavily contaminated, due to the fact that the main sources of supply were poorly capped and in many instances the water mains were broken. This state of affairs was remedied in the past year, new pipes were laid, and automatic chlorinators installed at every source of supply. Another factor which must not be disregarded is the rigid campaign of prophylactic vaccination against typhoid that was instituted by the Service d'Hygiene. This has been rigidly carried out during the past year, and literally thousands of people, including all school children, have been immunized.

Throughout this series not a single case of bacillary or amoebic dysentery came to necropsy. So far as I know, no case of proven bacillary dysentery has occurred at the Haitian General Hospital in

the past three years, although a few cases were reported in other districts. Occasionally cases of amoebic dysentery and *Balantidium coli* infestations have appeared in the wards, although no deaths from these conditions resulted.

Acute peritonitis ranks next as a cause of death in the gastrointestinal series, with a total number of 9 cases. The majority of these were the result of strangulated hernia and infection following operation. No case of acute appendicitis was found, although 2 cases from peritonitis occurred as a result of ruptured gastric ulcers. Carcinoma of the stomach ranked next in importance, with a total of 8 cases. This condition will be discussed later under the heading of "malignancy."

As regards intestinal worms, we found 9.7 per cent of the cases showing worms. This is in contrast to the laboratory findings on patients in the hospital, who run an average of between 35 and 40 per cent infestation. The reason for this low necropsy finding is due to the routine worm treatment given all hospital patients immediately following a laboratory diagnosis. When worms are found at necropsy, their number is consequently small. It is rare to find a body harboring more than three or four. *Ascaris lumbricoides* is probably the most common worm in Haitians, with *Trichuris trichiura* and *Necator americanus* coming next. It is interesting to note that no Old-World species of the hookworm were found in any case.

Up to the present no *Taenia* have been found in a Haitian. This does not mean that Haitian beef is free from infestation, as frequently foreigners living in Haiti come to the hospital heavily infested with *Taenia saginata*. In one case a Syrian who was treated with male fern in the private ward passed 8 distinct heads of *Taenia saginata* and a total of 135 feet of the worm itself.

Concerning intestinal parasites, I would like to present two cases of *Strongyloides* infestation which were extremely heavy. The worms here produced definite symptoms, which led me to believe were the actual causes of death.

I will not attempt to discuss the pro and con as to the pathogenicity of *Strongyloides*, but will present the cases as they were found and leave the discussion thereof to those more qualified to say. I am, however, of the opinion that *Strongyloides* and also *Trichuris* can cause definite symptoms and even death when such infestations are extremely heavy in patients with low resistance. The symptoms and necropsy findings in both cases of *Strongyloides* disease were practically identical, as follows:

Case 1 was a woman 28 years of age. Case 2 was a man of about 60 years. Both gave a history of diarrhoea of several months

standing. They were emaciated and complained of great weakness, colic, and frequent stools. Laboratory examinations of the stools showed a writhing mass of *Strongyloides* larvæ which numbered more than 200 per low-power microscopic field. The stools were of a pea-soup color and consistency, but no trace of blood, either macro- or microscopically was found.

Case 1 was given 1 c. c. of oil of chenopodium in castor oil the day of admission. She died the following morning.

Case 2 was given supportive treatment and later santonin. He died five days later.

Death in both instances appeared clinically to result from the profuse diarrhœa, associated with exhaustion and acidosis. The post mortem findings were similar to what one might expect in a fatal case of hookworm disease. The subcutaneous fat was absent; the muscles were pale and poorly nourished. All organs were atrophied and the thorax and abdomen contained free straw-colored fluid. The small bowel in each case was congested, edematous, and filled with a greenish-colored liquid fecal material. The mucous membrane showed no area of excoriation or ulceration, but it was definitely hyperæmic. Scrapings from the mucous membranes in various areas, from the duodenum to the cecum, showed numerous adult females and larvæ. None of the worms, however, were found in the colon, although as many as 10 to 15 adults were present in one drop of the scrapings from the ileum. Careful search of all the organs failed to reveal any gross lesions, other than just described, which could be responsible for death.

My opinion is that the heavy infestation with this parasite produced the profuse diarrhœa which resulted in the emaciation and subsequent exhaustion. The above, associated with a possible absorption of toxic products from the thousands of worms present, caused a general toxemia, acidosis, and death.

We have never encountered a case of heavy *Trichuris* infestation in Haiti; our greatest find numbered not more than 20. It was shown, however, by Dr. Lawrence Getz, of the Herrick Clinic of Panama, the autopsy protocol of one of his cases in which he believed death was due to *Trichuris trichiura*. The case in question was a child of about 5 years of age who presented symptoms similar to those described for our cases of *Strongyloides*. Necropsy revealed the colon almost filled with the worms, and he recovered by actual count over 1,700 adults.

Gastric ulcer and acute gastritis are not commonly encountered in the Haitians. Of the series of necropsies just completed, only one case of acute gastritis was found and three cases of gastric ulcer. In all of the ulcer cases the lesion was on the posterior wall of the pylorus and had perforated with a subsequent peritonitis.

The peasant Haitian, as a rule, eats rather coarse highly seasoned food and in the majority of instances imbibes freely of strong alcoholic drinks. In view of the above negative findings it must therefore be admitted that alcohol and highly seasoned food do not predispose to gastric ulcer, at least in the Haitian.

One case of gastric ulcer was most interesting. In this instance the pylorus was almost completely closed with scar tissue and would scarcely admit the stem of a match. The morning of the day the patient died she ate a large meal consisting of rice, beans, and mangoes. As this material could not leave the stomach, much fermentation resulted and the stomach became so distended with gas that it ruptured just above the pylorus through the anterior abdominal wall. A generalized subcutaneous emphysema resulted, which caused death within an hour after admission to the hospital. Post-mortem findings revealed a large amount of the stomach contents underneath the right pectoral muscles, with emphysema extending from the scalp to the tips of the fingers and toes.

THE LIVER AND SPLEEN

Diseases of the liver in Haitians are not important factors as regards the actual cause of death. Out of our present series we have found only 5 cases of cholelithiasis and 10 of true cirrhosis. The main liver damages found are fatty changes and chronic passive congestion concomitant to a myocarditis. One case of abscess of the liver was encountered in a patient who died of pyemia; however, no evidence of amoebiasis was present.

It is of interest to note the low percentage of cirrhosis of the liver recorded. Of the 10 cases reported here, eight were in the first 300 necropsies. Of these 8, only one was of the extreme hobnailed variety, the others being relatively mild in nature and secondary to other diseases. The 2 cases found in the last 400 necropsies were, however, of the characteristic atrophic type.

The true etiology of cirrhosis is still a matter of discussion, but it is generally accepted that treponematoses, chronic alcoholism, and focal infections are at least contributory causes. Syphilis and yaws we know are common in Haiti, as over 60 per cent of the dispensary cases show a strong positive serum reaction. Focal infection is practically universal and chronic alcoholism is common. With these factors regarding the etiology of cirrhosis overwhelmingly present, and in view of our relatively negative findings, it seems reasonable to assume that other factors regarding the etiology of this condition will stand investigation.

Malignancy of the liver is occasionally found. In this series under consideration we had one case of primary carcinoma (fig. 5), two of

carcinoma secondary to cancer of the head of the pancreas, and a fourth secondary to an abdominal lymphoblastoma.

The spleens examined so far afford a very interesting study. We found in four cases very large spleens which varied in weight from 800 to 1,600 grams. We also found, especially in the aged, a great number which averaged in weight between 60 and 90 grams. The average weight of all of the spleens, excluding the four large ones and all of those of children under 5 years of age, was found to be 160 grams. The largest spleens were in young adults, especially those dying from tuberculosis, typhoid, pneumonia, and malaria, while the smallest ones were, as a rule, in people past middle age.

Unfortunately malaria smears were not made from all of the spleens examined, but we must conclude that a large percentage would have shown parasites and pigmentation, judging from the findings of those examined. Our hospital records show for the past year that 15 per cent of the patients examined on admission had malarial parasites in the blood. Furthermore, Wilson found on a recent survey of 11,000 adults and 2,007 children from rural districts that 23.5 per cent of the adults and 50.5 per cent of the children were positive for malaria. The thick film method of blood examination was used in both the hospital and on the above surveys. The discrepancies between the two findings was undoubtedly due to the fact that a large majority of the hospital patients came from well-sanitized districts. In every instance where such cases terminated fatally no difficulty was encountered in identifying the parasites of malaria in smears from the splenic pulp.

In practically all cases of miliary tuberculosis the spleens have been universally involved and showed tubercles of various size together with a general hyperplasia. In some instances the surface as well as the cut section showed the spleens literally filled with miliary tubercles. (Fig. 6.)

Probably the most interesting spleen found was in the case of a boy 17 years of age. His illness dated back two and one-half months during which time he had lost much weight and had become very weak. Physical examination revealed an emaciated boy with a spleen practically filling the entire abdomen. The red blood count was 1,500,000, hemoglobin 30 per cent, white blood count 10,000 with a normal differential. He died five days after admission as a result of internal hemorrhage with a clinical diagnosis of Banti's disease. Necropsy revealed the abdomen filled with blood which came from a large necrotic mass attached to the under surface of the right lobe of the liver. The mass also involved the right kidney and retroperitoneal and mesenteric lymph nodes. The spleen extended from the diaphragm to the brim of the pelvis. It was dark

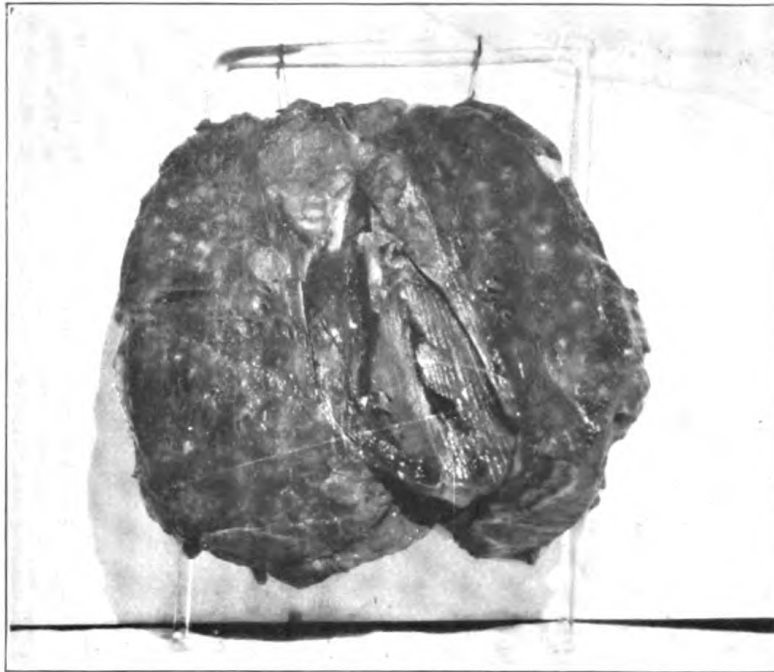


FIGURE 1.—MILIARY TUBERCULOSIS. HEART AND LUNGS OF AN INFANT. (CHOISSER)

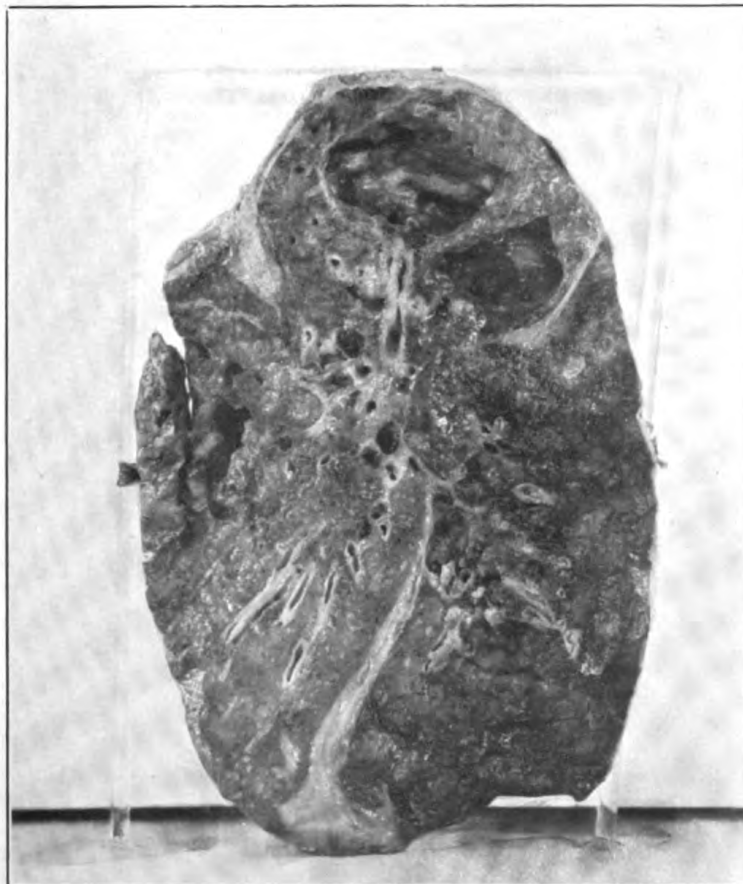


FIGURE 2.—ULCERATIVE TUBERCULOSIS OF LUNG WITH CAVITY FORMATION IN A PATIENT WHO CLAIMED TO BE 100 YEARS OLD. (CHOISSER)

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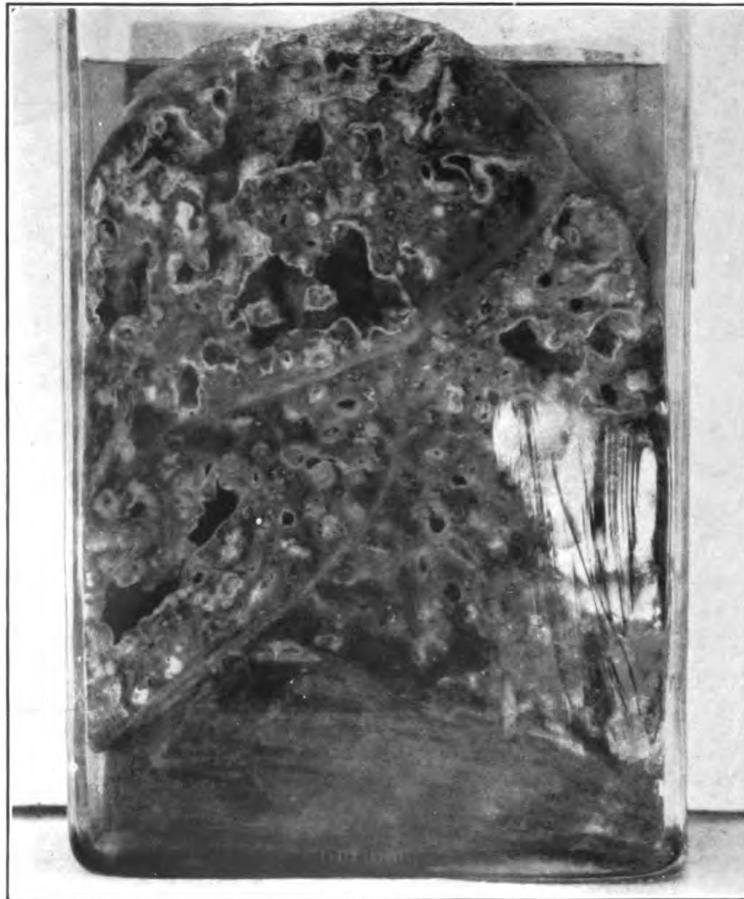


FIGURE 3.—MASSIVE ULCERATIVE TUBERCULOSIS OF LUNG. GROUP I.
(CHOISSER)

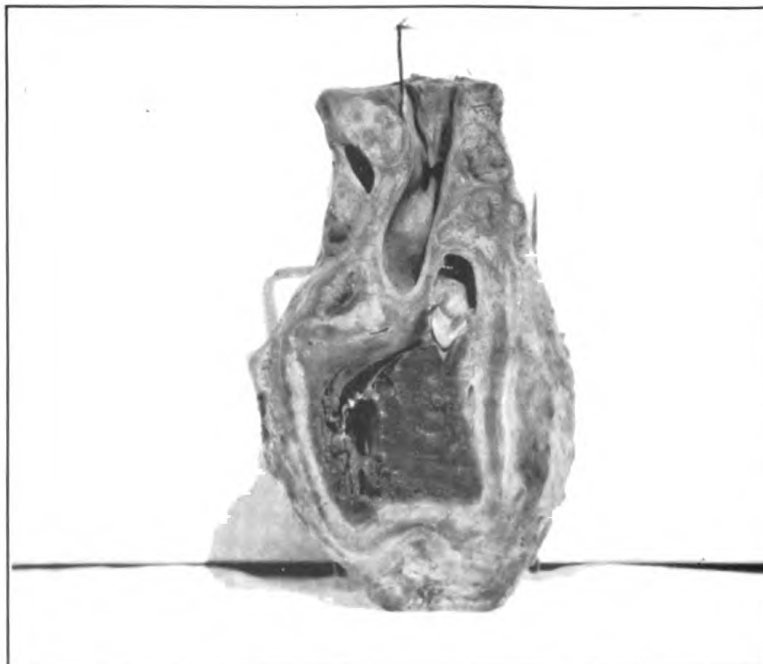


FIGURE 4.—TUBERCULOSIS OF THE HEART AND PERICARDIUM. GROUP II.
(CHOISSER)

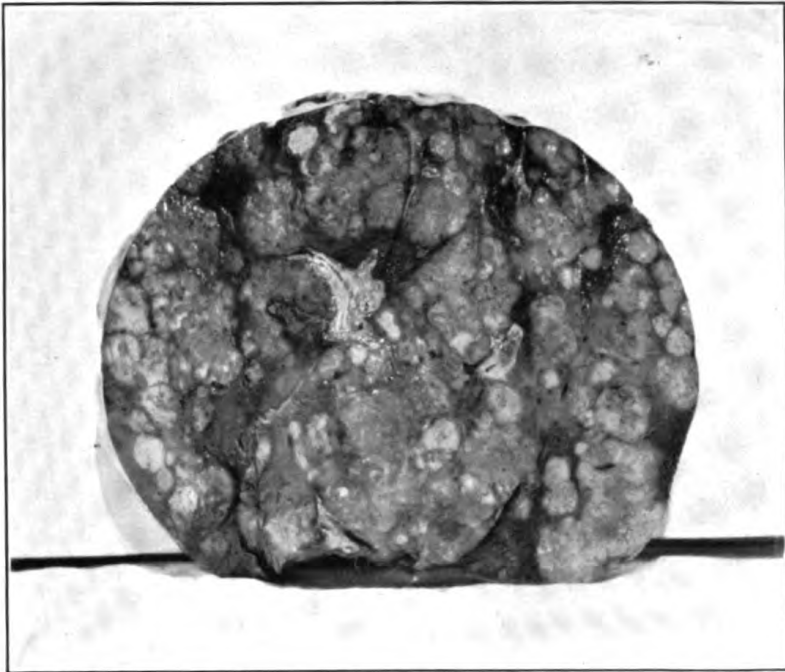


FIGURE 5.—PRIMARY CARCINOMA OF THE LIVER IN A PURE-BLOODED HAITIAN.
(CHOISSER)

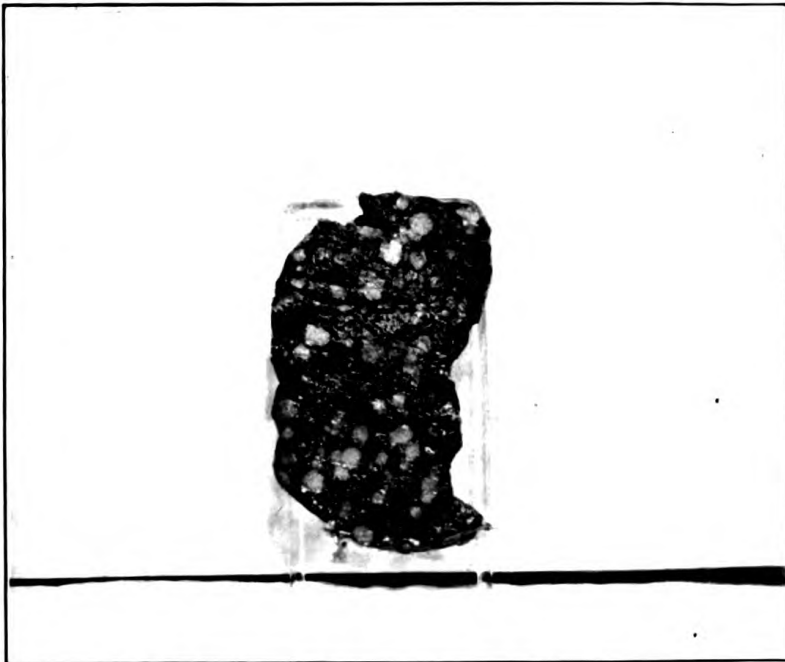


FIGURE 6.—SPLEEN. MILIARY TUBERCULOSIS SHOWING LARGE TUBERCLES ON
CUT SECTION. (CHOISSER)

558—3

blue in color, soft, and covered with large white nodules; weight 1,200 grams. Cut section showed extensive necrosis and the normal splenic pulp practically replaced by large soft white masses. (Fig. 7.) The liver also showed several small white nodules on the surface. Microscopic diagnosis of all the tissues involved revealed the condition to be a lymphoblastoma of the pseudoleukemia type.

GENITO-URINARY SYSTEM

The cause of death from diseases of the genito-urinary system is quite common. Chronic interstitial nephritis leads the list, with 61 deaths, or 8.7 per cent of the total. All grades of chronic nephritis have been found, which varied from the large red or white kidney with a smooth cortex to the very small contracted arterial sclerotic type, with a rough granular surface.

It is interesting, in view of the many cases of so-called renal colic reported, that in only one instance was a renal calculus found at autopsy. In this case the stone was very small and was located in the medullary portion of the kidney. It may also be mentioned here that no calculi have ever been found at necropsy in the ureters or bladder; however, a few bladder stones have been surgically removed from patients in the hospital.

The water of Haiti is very hard and contains a high percentage of so-called temporary hardness. This is evident from the fact that a heavy precipitate of calcium carbonate falls after boiling. It is consequently believed by many that the long-continued use of this water predisposes to a similar precipitation in the kidney pelvis, with the resulting calculi formation. Our negative necropsy findings do not confirm this belief.

Single kidneys were found in three cases. In the first case the kidney was large, almost round in shape, and rested in the midline on the promontorium of the sacrum. It had two short ureters and was histologically normal. Case 2 was a typical horseshoe kidney, which had similar anatomical relations and was also normal in gross and microscopic appearance. It had two short renal arteries and ureters. In the third case the right kidney was in normal position but twice the normal size. Only a vestige of the left kidney remained, which was about the size of a small filbert and possessed a distinct ureter and a fibrotic renal artery.

Tumors of the genito-urinary tract are not especially uncommon. In this series we found one primary carcinoma of the kidney, one carcinoma of the bladder, one carcinoma of the ovary, four carcinomas of the uterus, and one enormous ovarian fibro-lipoma. The latter case was interesting on account of the size of the tumor and

the age of the patient. The tumor occurred in a girl 16 years of age and weighed when removed 56 pounds. This was only 10 pounds less than the weight of the patient following the operation.

One case of ruptured ectopic pregnancy was found in which the correct diagnosis was not evident until necropsy. The patient was a young well-developed female who was brought to the hospital in coma and extreme shock without a history. Physical examination revealed nothing unusual with the exception of a slightly distended abdomen and a temperature of 100° F. Malaria smears taken at the time, as routine procedure, showed the blood teeming with malignant tertian parasites. The case was transferred to the medical service and large doses of quinine administered intravenously. She died during the night without regaining consciousness. Necropsy the following morning revealed the abdomen filled with blood and a ruptured right fallopian tube which contained a well-formed foetus of approximately two months duration. This case is of interest from the fact that the two serious conditions occurred simultaneously and also that it should teach physicians practicing medicine in the Tropics that the finding of a heavy malaria infection in a patient does not preclude the possibility of a more serious acute surgical condition.

DISEASES OF THE NERVOUS SYSTEM

In this series we had 18 deaths, or 2.5 per cent of the total, from meningitis. The disease itself can by no means be considered common, although cases are found from time to time. The causative organism in these 18 cases were as follows; one due to *B. tuberculosis*, 12 to the *pneumococcus*, proven by both smear and culture, and 5 to the *meningococcus*. The latter cases occurred during an epidemic of meningitis in July and August, 1928. The case of tuberculous meningitis was one in which tuberculosis of the lung was the outstanding manifestation, although definite involvement of the spinal meninges was demonstrable clinically. Ten of the pneumococcus cases were directly associated with and followed infection of the middle ear. One case occurred in the course of lobar pneumonia, while the primary focus of infection of the remaining one could not be found. The brains and meninges, with the exception of the case of tuberculous meningitis, were injected and very edematous. The pia in all instances were covered with a thick layer of pale yellow pus which showed many organisms on direct smear.

Spontaneous intracranial hemorrhage was found in five cases. Three of the five occurred in young adults who were infected with yaws and two were in old people with a negative history and serum reaction. The yaws cases gave histories of having been infected in childhood and of never having taken treatment. The blood serum reaction in each instance was four plus. One case of glioma was

found in a child 7 years of age. The tumor had apparently originated in the right retina and caused death in about four months by destruction of a large part of the frontal lobe of the brain and adjacent bony parts.

Two cases of rabies occurred during this series following the bite of rabid dogs. The patients came to the hospital after the disease was well developed and stated they had not taken anti-rabic vaccine. The first was that of an elderly woman who was bitten on the leg 28 days before admission. The second was a young girl who was bitten on the hand 21 days prior to the initial symptoms. They both died in convulsions the day following admission. The autopsy findings in both cases showed congestion of the brain and meninges. The spinal fluid was clear and apparently not under pressure. Smears taken from the hippocampus and stained by Frothingham's method showed many Negri bodies within the large ganglion cells.

PATHOLOGY OF THE CARDIO VASCULAR SYSTEM

We were surprised to find in this series the relatively low ratio for endocarditis both specific and nonspecific. We found only two cases of actual mitral endocarditis, one following a resolving lobar pneumonia and the other a phlegmon of the leg. Both of these cases were terminal affairs and of the ulcerative type. In the pneumonia case the tricuspid valve was also involved and perforation had occurred into the right auricle. Four cases of chronic mitral disease were found which showed a relative degree of stenosis in all instances. These latter cases were not of the severe type and produced no symptoms during life. In no instance did we find the contracted indurated so called fish-mouth type of stenosis.

Chronic aortitis was present in three cases in old syphilitics. In one of these cases large vegetations were present on the aortic leaflets and resulted in sudden death from cerebral embolism.

Acute pericarditis was present in three cases concomitant to a left pleurisy, two cases of chronic tuberculous pericarditis were found and two of nonspecific adherent pericarditis.

The finding of only six cases of endocarditis, with four of these being so mild as to cause no symptoms during life, seems to me to be extremely low. This is especially interesting in view of the fact that focal infection is present in almost 100 per cent of the cases of the class of patients admitted for treatment. Mouth hygiene in Haiti is as a rule sorely neglected among the laboring class, and there is rarely a case in the ward over 20 years of age that does not show extensive pyorrhea and infected tonsils. Apical infection, however, is not common for the reason that prosthetic dental work is never done on the dispensary class of patients. When their teeth become

sore or begin to ache the patient goes to the nearest rural clinic and has them extracted. They, therefore, are not troubled with the annoyance and potential danger of crowns and filled root canals. Acute rheumatic fever, erysipelas, and other streptococcus infections are also practically never seen in the rural clinics and public health hospitals. These findings are undoubtedly the deciding factor, which accounts for the low rate of endocarditis.

PATHOLOGY OF MALARIA

During the period of this report we had six deaths from malaria. Two occurred in 1927 and four in 1928. All of the cases presented similar symptoms and showed the same gross and microscopic pathological findings, inasmuch as they were all of the malignant tertian type of infection.

The patients were admitted to the hospital in coma or a stuporous condition with the following temperatures, one subnormal, one 100° F., and a range from 104° to 106° F., in the others. Thick film blood examinations showed from 200 to 500 malignant tertian parasites to the field, but no crescents.

The brains upon examination were pinkish gray in color, edematous, and firm to touch. When sectioned the white matter was congested and showed numerous scattered areas of punctate hemorrhages. Smears from the brain substance, stained with Azur-II eosin, showed the capillaries engorged with pale red cells containing young gametes. The parasites were rather large, oval in shape, with a thick pale blue cytoplasm and a central clump of pigment. These forms of the parasite are called by Dr. H. C. Clark, director of the laboratories of the Gorgas Memorial, sexual ovoids. They are found only in the brain, spleen, and bone marrow, apparently never invading the peripheral blood stream.

The spleens of these cases varied in size; however, all showed a definite hyperplasia. Direct smears from the pulp, stained as above, showed heavy pigmentation with numerous sexual ovoids evenly distributed. No ring forms or full grown crescents were found, although many of the parasites appeared larger and more developed than those found in the capillaries of the brain.

The bone marrow was light brown in color and of a pasty consistency. Direct smears showed many sexual ovoids of a more advanced stage together with numerous full grown crescents with central clumps of pigment, but no rings.

It is obvious, therefore, that the large sexual forms in fatal malignant malaria are confined to the bone marrow, spleen, and brain, where sporulation takes place. The parasites may attain full development in the spleen and bone marrow, but not in the brain, as their

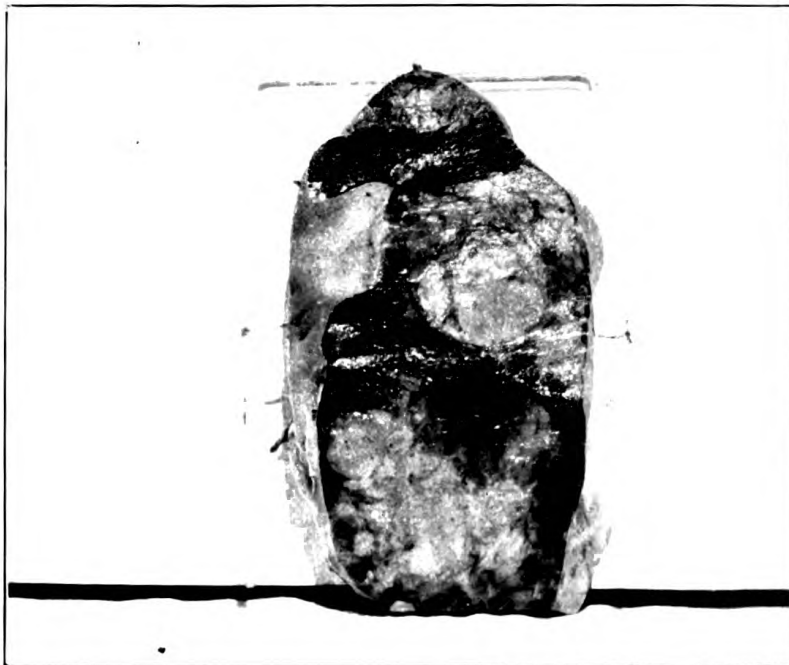


FIGURE 7.—SPLEEN, LYMPHOBLASTOMA IN A HAITIAN. THE WHITE AREAS ARE NEOPLASTIC TISSUE. (CHOISSER)

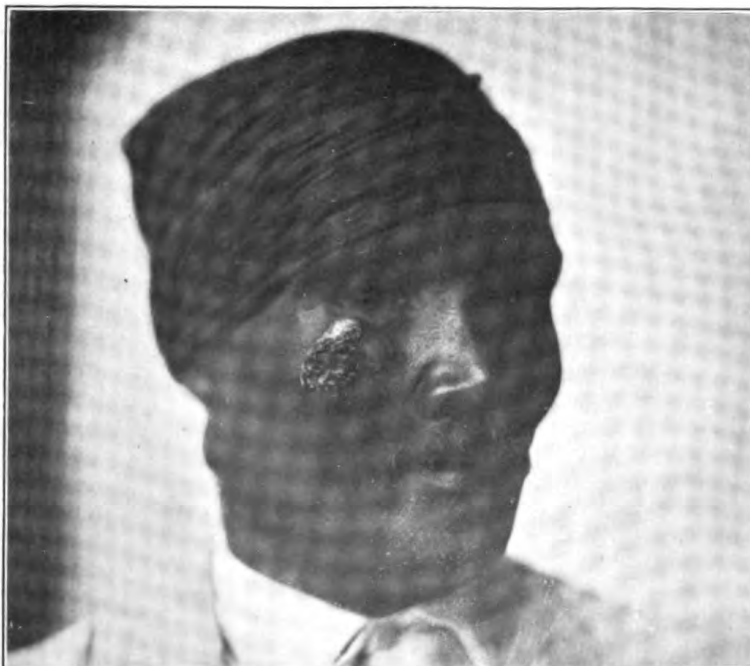


FIGURE 8.—BASAL CELL CARCINOMA OF THE FACE IN A FULL-BLOODED HAITIAN. (CHOISSER)

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FIGURE 9.—ANEURYSM OF THE AORTA IN A CASE OF TERTIARY YAWS.
(CHOISSER)



FIGURE 10.—HEART AND AORTA SHOWING RUPTURED
ANEURYSM IN A CASE OF TERTIARY YAWS. SEE
FIGURE 9. (CHOISSER)

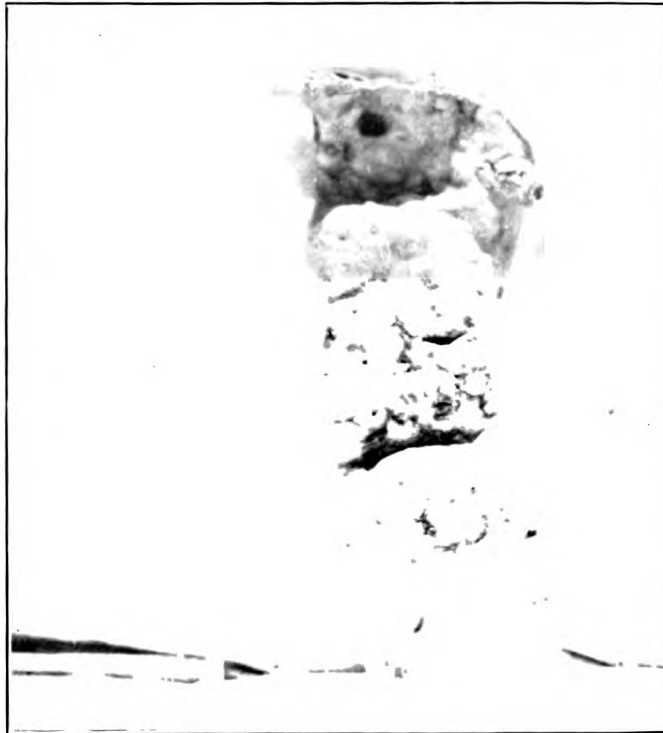


FIGURE 11.—ULCERATIVE AORTITIS IN A CASE OF TERTIARY YAWS.
(CHOISSER)



FIGURE 12.—HEART AND LEFT LUNG SHOWING ANEURYSM WHICH
RUPTURED INTO LUNG AND LEFT THORACIC CAVITY. CASE OF
TERTIARY YAWS. (CHOISSER)

large size blocks the capillaries, producing infarction and death before the parasite has time to attain full development.

MALIGNANCY

One point that is well worth consideration at this time is the much-debated question of malignancy among primitive races. It is the general consensus of opinion that cancer is extremely rare in people of the African race. I am thoroughly convinced from our necropsy findings and examinations of microscopic specimens from biopsies that this view is a misconception. The low mortality rate from cancer in the Tropics is, in my opinion, due to a lack of scientific study rather than to a rarity of the disease itself. It is readily accepted, among both the laity and medical profession, that benign tumors such as keloids, lipomata, and fibromatoma, are quite common in the Tropics. These tumors are usually very large and make their presence known by their size alone. As the benign tumors are known to be common, it is only reasonable to assume that cancer should also be present. The fallacy arises not from any rarity of cancer, but from the lack of autopsies and a careful search of microscopic sections from suspicious tumors. Cancer is a universal disease and all races, whether primitive or otherwise, are susceptible, irrespective of the climate in which they live.

A very interesting brochure has been published by the chief statistician of the Prudential Insurance Co. of America, entitled "Cancer in Native Races." This publication was compiled from answers to letters written to physicians in the more important centers of the world regarding the prevalence of cancer in their localities. Replies from practically all places where the African race predominates were to the effect that cancer was rare. The replies also indicate that in localities where admixture of the Caucasian race is evident that cancer is not uncommon, its ratio being in proportion to the degree of admixture of the two races. At first thought one may conclude from these findings that the white man is susceptible to malignancy and the pure-blooded black immune. Such a conclusion is not well founded, because in countries such as South Africa, where the black man predominates, very little scientific study along these lines is carried on and statistics are for the most part admittedly unreliable.

At the Haitian General Hospital a great majority of the patients are of the pure-blooded African type, and our figures correspond closely to those revealed as existing in the Congo. For example, in the years before necropsies became routine here, the death rate from cancer was practically nil. Furthermore, we have no authentic records to show that cancer, from a microscopic standpoint, ever existed. We must, however, assume from our present findings that cancer cases were admitted, but remained undiagnosed.

Our records at present show that 27 deaths, or 3.8 per cent of the total, were from malignancy alone. Three of these were caused from sarcoma and 24 from carcinoma. Furthermore, out of a series of 486 consecutive biopsies from specimens received from various places of the island we found 75, or 15.4 per cent, to be malignant. The cancers found in microscopic sections from tumors removed at operation were as follows: Adenocarcinoma, 32; squamous cell carcinoma, 24; basal cell carcinoma, 5 (fig. 8); pigmented melanoma, 3; non-pigmented melanoma, 3; lymphoblastoma, 2; and fibro-sarcoma, 6. One interesting point was that in all of the cases of nonpigmented melanoma the original growth was on the heel.

The microscopic appearance of the cells of the various cancers differed in no way from those found in neoplasms of temperate climates. In the majority of instances the cancer cells were of the embryonic, anaplastic type, and consequently, according to Broder's classification of malignant tumors, of the highest grade of malignancy. In such tumors one would naturally expect early diffused metastases, but it was surprising that diffused metastases were rarely observed, even when dealing with these apparently high-grade malignant neoplasms.

One case of a rapidly growing fibrosarcoma of the leg of a Haitian boy 17 years of age caused death in 4 months after the original diagnosis. The tumor grew very rapidly, until at the time of death it weighed almost as much as the body of the patient. Careful necropsy revealed only a slight involvement of the inguinal region by direct extension and no metastases in distant organs.

The above figures certainly do not show the African race to be immune to cancer, but they do suggest the possibility that the black man may possess a certain immunity to the metastatic distribution of malignant cells, a condition not found in those of Caucasian descent.

PATHOLOGY OF YAWS

We have been rather fortunate in this series of necropsies in having the opportunity to study the pathology of yaws. Over 65 per cent of our cases gave a clinical history of either syphilis or yaws infection at some time during life. The histories, however, in many cases had to be disregarded concerning the exact type of infection, inasmuch as conflicting statements were not uncommonly given by the patients during their stay in the hospital. Regardless of this we have a series of 10 definite cases of yaws, pure and simple, with a negative history of syphilitic infection and no evidence of scars on the genitalia. Eight of these cases were aneurysms of the aorta, one a gumma of the brain, and the other a spontaneous cerebral hemorrhage.

The pathological processes found in these definite cases of yaws differed in no way, so far as we were able to ascertain, from those found in the usual routine cases of treponematosi. Under this title we classify that great group of infections of doubtful yaws and syphilis. In fact, the pathology found in the definite yaws cases and those of so-called treponematosi was so similar from both a gross and microscopic standpoint that it was impossible to differentiate the two.

The principal lesions produced, upon which we based our diagnosis of treponema infection, were found in the cardio-vascular system. The character of the lesions depends upon the chronicity of the infection rather than upon whether we choose to call it syphilis or yaws. I regret, therefore, my inability at this time to conscientiously differentiate the pathological process resulting from the two types of infection.

The earliest pathological evidence of visceral yaws is noted by changes in the aorta, which occurs quite early in the course of the disease. One will find evidence here when the only other clue to infection is the scar of the mother yaw. This change appears to be a degeneration of the intima with resulting scars associated with fatty changes. The lesions begin about 5 millimeters above the aortic cusps and in the early stages extend only to the transverse portion of the arch. In the later stages the entire aorta may present a picture of extensive atheromatous degeneration and in some cases ulceration. In one case of severe yaws aortitis, the intima and media were detached in long strips, which produced an exfoliative condition.

One point of interest that is well worth mentioning is the fact that the heart valves themselves are not often involved. We found only two cases with vegetations upon the aortic cusps and these were not large. In no case did we find evidence of ulceration with the resulting aortic stenosis.

Aortic aneurysm is not uncommon in late yaws. Many varieties were found, varying from the spindle-shaped dilatation of the ascending portion to the large sacculated variety. These sacculated aneurysms occurred more frequently in the arch and its direct branches; however, two large ones were found in the thoracic portion and one at the origin of the celiac axis. They all caused pain and discomfort, due to pressure, and tended toward early rupture.

The following aortic aneurysms which occurred in definite yaws cases with a negative history of syphilis are of interest. Case 1 was a man 65 years of age who gave a history of yaws in childhood. He had a large aneurysm which involved the ascending and transverse portion of the arch and ruptured externally through the chest wall. (Figs. 9 and 10.) Case 2 was a man about 40 years of age with a

history of yaws of 10 years' duration. The aneurysm was in the descending portion of the aortic arch and ruptured into the left thoracic cavity and left bronchus. (Fig. 12.) Case 3 was a man 36 years of age with a history of yaws when a child. He presented a huge aneurysm of the abdominal aorta which proved at necropsy to have originated at the origin of the celiac axis. This ruptured spontaneously into the abdomen. (Fig. 13.) Case 4 was a large aneurysm of the aorta which involved the innominate artery. This aneurysm did not rupture but caused death from suffocation through pressure and complete occlusion of the trachea at its bifurcation. (Fig. 14.)

The heart muscle in late yaws seems to be definitely affected. The epicardium is more or less opalescent with the appearance of areas of porcelain-like patches; these areas are also frequently seen in the endocardium. The myocardium is usually thin and flabby, rarely showing fibrosis or hypertrophy.

The liver in cases of old and untreated yaws frequently shows small superficial punctate scars. These areas on section show an actual degeneration of the liver substance, with definite circumscribed round-cell infiltration. In fact no case has been found of the extreme hobnailed variety of cirrhosis where a clear history of yaws alone was obtained. It is possible that the high percentage of malarial infection found in Haitians may have some bearing on the above pathological findings. Gummata of the liver are also rare, but do occur, as we observed one the size of a hen egg in a case with a negative syphilitic and positive yaws history. In another case of tertiary yaws a gumma was found in the frontal lobe of the brain. It had extended through the calvarium and caused a circumscribed destruction of the frontal bone. (Fig. 15.)

Regarding the nervous system, the most common finding is spontaneous hemorrhage into the brain. In one case the hemorrhage occurred into the spinal cord. This was diagnosed clinically as tabes dorsalis and aroused much interest, inasmuch as up to date no case of tabes had been found. The autopsy findings, however, revealed the true nature of the condition to be a spontaneous hemorrhage into the central canal.

In the present series of cases we found four spontaneous cerebral hemorrhages. These all occurred in young adults with clinical histories and symptoms of yaws infection. They were not cases of hypertension, but on the contrary presented systolic pressures below what one may expect for the age.

Sudden death therefore is not infrequent amongst cases of untreated yaws of long standing. Consequently, experience from necropsy observations in cases of sudden death where yaws infection was evident prompts a preoperative diagnosis of either cerebral hemorrhage or rupture of an aortic aneurysm.

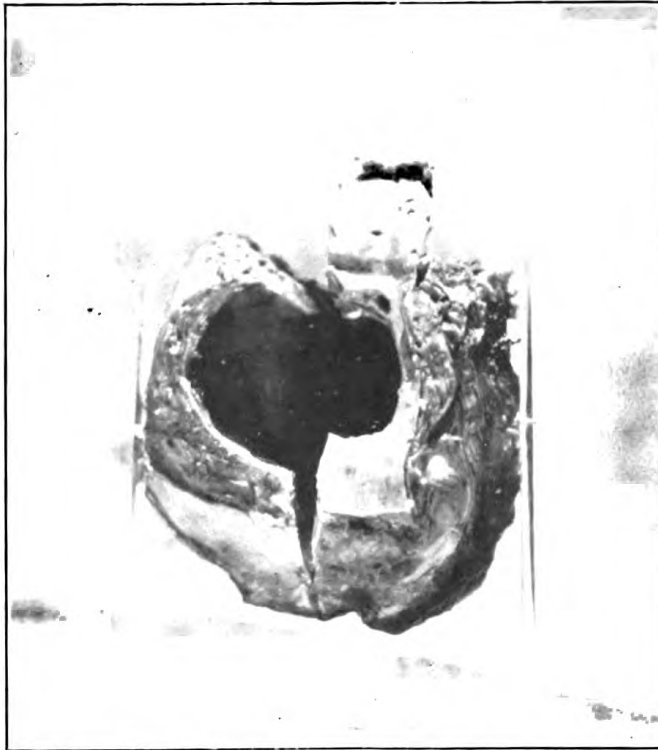


FIGURE 13.—RUPTURED ANEURYSM OF THE AORTA AT ORIGIN OF CELIAC AXIS. CASE OF TERTIARY YAWS. (CHOISSER)

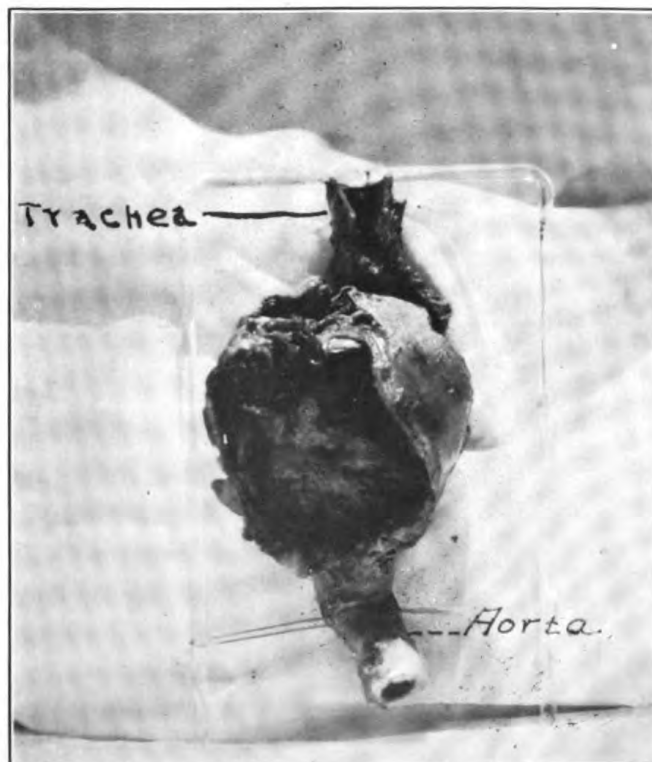


FIGURE 14.—ANEURYSM OF THE INNOMINATE ARTERY IN CASE OF TERTIARY YAWS. DEATH RESULTED FROM ASPHYXIA DUE TO PRESSURE AND OCCLUSION OF THE BRONCHI. (CHOISSER)

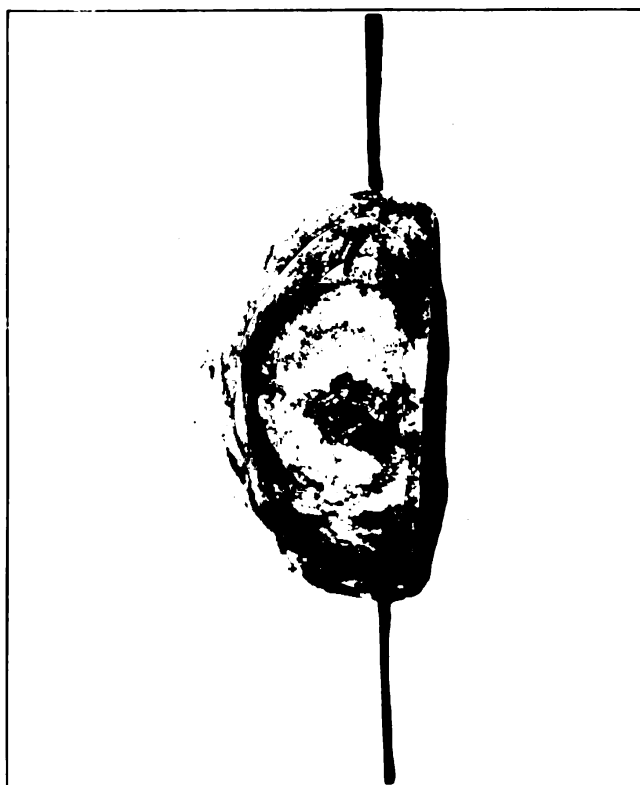


FIGURE 15.-GUMMA OF FRONTAL BONE IN CASE OF TERTIARY
YAWS (CHOISSER)

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SUMMARY AND CONCLUSIONS

1. This series of 700 consecutive autopsies were performed at the Haitian General Hospital, Port au Prince, from June, 1926, to January, 1928.

2. Due to the ideal location of the hospital, our findings should be fairly representative of the mortality rate of the island, as patients are received from all parts of the Republic.

3. The most outstanding cause of death amongst the Haitians was found to be pulmonary tuberculosis, which averaged 26 per cent of the total.

4. The gastro-intestinal system was responsible for death in 33, or 4.7 per cent of the cases. Of this number, 10 were due to typhoid in 1927 and 3 in 1928.

5. No deaths resulted from bacillary dysentery or intestinal protozoal infestations, although two deaths were attributed to a heavy infestation with *Strongyloides stercoralis*.

6. Cirrhosis of the liver is not especially common in the Haitian. Ten cases were recorded in all, with only three of these being of the typical atrophic type.

7. Gall stones and renal calculi are also rare. We found five cases of the former and only one of the latter in the entire series and these produced no symptoms during life.

8. The size of the spleens in Haitians is not above normal. The average weight was 160 grams, excluding four extra large pathological ones and all those in children under 5 years of age.

9. Acute nephritis is rare, although chronic nephritis is quite common. We had a total of 61, or 8.7 per cent, of deaths from this cause.

10. Endocarditis, both of the acute and chronic type, is rare in Haitians. Two cases of acute mitral disease were found in terminal acute infections and five cases of chronic endocarditis. Four of the latter were of the mitral valve and one of the aortic leaflets.

11. Death from malaria is not uncommon in Haiti. Our records show six deaths from this condition, all of which were caused by the malignant tertian parasite. The parasites in each instance were demonstrated in the brain, bone marrow, and spleen pulp, by direct smear.

12. Malignant disease was found to be just as common in Haitians as in other races in temperate zones, and the cell type of the cancers differed in no way from those common to Caucasians.

13. Carcinoma was seven times more common than malignant connective tissue tumors.

14. Regardless of the apparent degree of malignancy of the various cell types of cancers, distant metastases were not common.

15. Five cases of basal cell tumors and three of nonpigmented melanomata were found in pure-blooded Haitians. The former were on the face and scalp and the latter on the heel.

16. The pathology of late untreated yaws so closely resembles that resulting from tertiary syphilis that it was impossible to differentiate the two without a clinical history.

17. The first pathological evidence of yaws infection in the internal organs was found in the aorta.

18. These early lesions manifest themselves by irregular linear scars and atheromatous plaques which begin about 5 millimeters above the aortic cusps.

19. The aortic valves themselves do not appear to be universally involved in tertiary yaws or in our late cases of so-called trepanematoses.

20. Late untreated yaws predisposes to aortic aneurysm, particularly of the arch. These cause much pain from pressure and tend toward early rupture.

21. Gummata of the liver and brain occasionally occur in tertiary yaws infection.

22. Spontaneous internal cerebral hemorrhage in the middle aged is not uncommon in late yaws.

23. Our observations indicate that sudden death occurring in young adults, with old yaws infection, should prompt a pre necropsy diagnosis of either internal cerebral hemorrhage or a ruptured aortic aneurysm.

PUBLIC HEALTH IN HAITI

A RÉSUMÉ OF 10 YEARS' WORK

By K. C. MELHORN, Captain, Medical Corps, United States Navy

FOREWORD

Prior to the American intervention in 1915 a national public-health service existed only as a loosely organized body of practicing physicians known as the *Jury Médical*. Poorly financed and without support from either the public or the courts, it never had and, as constituted, never could have entered upon a stage of progressive activity. As a result, the whole country teemed with filth and disease, and Haiti, shunned by a frenzied world, had reached the stage of hopeless chaos. From sheer necessity the first of the major tasks assumed by the intervention was that of hygiene and sanitation. The few so-called hospitals, which were really nothing but miserable shacks to which more miserable human wrecks were brought to die, were taken over by the naval medical officers. Systematic community

sanitation was inaugurated, and for the first time in over 100 years a constructive program of public health began to function.

In considering the problems presented for solution in 1915 and in weighing the results attained one should keep in mind the following facts:

(a) That Haiti (the old Carib Indian term for "mountains") is all that the name implies;

(b) That its total area is about that of the State of Maryland;

(c) That it possessed a population of approximately 2,000,000, 90 per cent of whom were illiterate;

(d) That a century had passed since any extensive road building had occurred;

(e) That an automobile was a thing unheard of to the majority of people;

(f) That the general average of the annual appropriations under which this service has operated in the 10 years of its existence is \$489,306, or a per capita of 24.46 cents.

RÉSUMÉ OF RESULTS

Organization.—On February 24, 1919, a law creating the National Public Health Service was passed. Under the direction of the sanitary engineer, whose title was later changed to director general, a sanitary code, similar to that of the United States, was adopted. Necessary rules and regulations pertaining thereto were drafted, approved, and published April 19, 1919. The country was divided into 10 districts to each of which were assigned United States naval medical and Hospital Corps personnel, Haitian doctors, and French nuns. In the succeeding years there have been added, as rapidly as their training permitted, doctors, nurses, sanitary inspectors, clerks, typists, laboratory technicians, chauffeurs, mechanics, cooks, etc.—a personnel numbering 2,010. Of this total, all are Haitians except 20 United States naval medical officers, 14 United States naval hospital corpsmen, 4 American Red Cross nurses, 63 French nuns, 2 French priests, 1 French librarian, and 1 Jamaican plumber.

Hospitals.—With all the old hospitals rebuilt and new ones erected in other sections, the country now possesses a total of 11 modern hospitals, with capacities ranging from 60 to 400 beds. Plans are under way to erect within the coming year two more—one of 150 beds for patients with mental diseases and one of 50 beds for the isolation and treatment of lepers.

Rural clinics.—For over 200 years three diseases have played havoc and exacted terrific toll in the lives of the Haitian people—yaws, malignant malaria, and intestinal parasites. To combat them and thus promote the economic development of the country there were

inaugurated in 1926 the building and equipping of a nation-wide system of rural clinics providing free treatments. These clinics now number 142 and are scattered over the entire Republic. Depending upon accessibility, they are held weekly, biweekly, and monthly. In the year 1928 the total mileage covered in this work was:

	Miles
By automobile.....	73,770
By horse.....	11,610
By motor boat.....	4,992
By airplane.....	1,000

Their success in reaching the people is evidenced by the following figures: Total consultations and treatments in 1927, 673,389; in 1928, 866,673. As an additional means of carrying treatment and the message of public health to the homes of distant mountain people, traveling clinics—pack-train units provided with tentage, medical and commissary supplies—in charge of American and Haitian doctors, have been recently provided.

QUARANTINE AND SANITATION.—A. Maritime quarantine regulations similar to those of the United States are enforced in all the open ports.

B. *Refuse disposal*.—A routine system of street cleaning and garbage removal has been instituted in all cities, towns, and villages. During the past year it has been possible to complete the equipping of all the 10 district centers with motor transportation for this purpose. In major part the refuse is used to fill swamps and reclaim tidelands.

C. *Mosquito control*.—With all the approved methods (including the use of airplane dusting) being employed, the incidence of malaria is rapidly diminishing in those locations where it is possible to concentrate resources. The cities of Port au Prince, Cape Haitien, Gonaives, St. Marc, Jacmel, and Jeremie now have the disease under excellent control and can be pointed to with pride.

D. *Malaria*.—Though the response to sanitary improvements effected in the larger towns and cities is very gratifying, the situation as regards malaria in rural districts continues to be a major problem. Eradication of this disease to the extent that it will be no longer a serious menace to economic development awaits two factors, the extension of mosquito-control measures and the widespread use of quinine. The first will occur just as rapidly and no faster than plantations and gardens can be properly cultivated, irrigated, and drained and just as fast and no faster than the people themselves can be enlightened in regard to prophylactic measures and possess the means and ability to live accordingly. Only by years of organized and well-financed effort can this level of attainment be guaranteed.

E. *Water-borne diseases.*—With the capping of springs and the installation of chlorination units a most gratifying reduction in morbidity rates for water-borne diseases is being witnessed. In the past 12 months the 7 water supplies of Port au Prince were brought under the above-mentioned control, with the result that typhoid-fever cases last year numbered but 7, with 2 deaths, as compared with 232 cases and 52 deaths the year before. From 1923 to 1927 the average number of deaths per year from this disease in the capital city was 38.7.

F. The sanitation of areas devastated by the hurricane of August 10, 1928; the equipment of the service technique dairy farm with a pasteurization plant; the procuring of all-metal carts for night-soil disposal; the placing of quinine within the reach of all, and extension of swamp-control measures at Gonaïves, Limbé, Petit-Goave, Miragoane, and Cayes constitute additional major accomplishments of the past year.

EDUCATION.—A. *Medical school and hospital training.*—The wisdom of the Government in effecting in 1926 the complete reorganization of the National School of Medicine, Dentistry, and Pharmacy, thereby gaining the splendid aid of the Rockefeller Foundation, is evidencing daily its soundness. By that crowning success this school became a unit second to none in the public health service, an enviable liaison existing in few other countries. Not only has it resulted in the construction and equipment of two beautiful buildings but, what is even more important, it provides constant opportunity for instilling public health into the minds and hearts of students. This close union has meant in no way a stinting of funds. On the contrary, by avoidance of duplication the appropriations now permit of developments heretofore impossible. The fact that every resource and facility of the service are not only available but in actual use for teaching and research purposes is an advantage possessed by few nations. Its importance to tropical medicine is evidenced by the numerous requests for data being received from foreign lands.

The manner in which the Haitian personnel at the medical school and on the hospital staffs are taking hold of the work is indeed gratifying. Particularly is this true of the physicians who returned last year from their Rockefeller Foundation Fellowship courses in the United States and Europe and of those doctors who have received the special training in administration procedures now a regular routine at the Haitian General Hospital of Port au Prince. Briefly, this last-named program functions as follows: Selected members of the Haitian staff are being detailed from one to three months as assistant administrators of that large 400-bed hospital. There, working side by side with the United States naval medical officer in charge, they study every detail of administrative work. In this practical way is there provided an opportunity for the doctors to come

into intimate contact with the responsibilities of the office and at the same time give us a close insight into the capabilities of each man. This system has met with an enthusiastic response on the part of all concerned, and it is planned to effect a similar development in every department and every division of the entire service as rapidly as conditions permit. Since this special intensive training was instituted 8 months ago, 3 of the 10 districts of the service are now functioning entirely with Haitian staffs, United States Naval Medical personnel having been withdrawn to institute new work in connection with public-health activities in the schools and the hospitalization of lepers and the insane, important projects not possible heretofore to undertake.

SALARIES.—A. As an illustration of salaries received by Haitian personnel before and after their employment by the public health service, the following data pertaining to the staff of the National School of Medicine are of interest:

Salaries paid	Before August, 1926	After August, 1926
Dean.....	\$300	\$350
4 clinic professors.....each..	200	200
10 clinic professors.....do..	30	100-150
Secretary, librarian, technicians, etc.....	30	60
Janitor.....	4	15

B. The training school of nurses.—With the assistance of the United States Navy Nurse Corps, and later that of the American Red Cross, this school, opened on October 15, 1918, has graduated to date 81 nurses, 70 per cent of whom are under employment. To broaden the scope of this type of training and to further utilize the services of this splendid corps of women, a public health nursing service has recently been instituted, and under a Haitian Government fellowship one of the graduates will be sent shortly to the United States for a year's special course in that work.

C. School health service.—Specially trained for the purpose, selected doctors, dentists, and nurses are now conducting medical examinations of pupils and sanitary inspections of school buildings in the district of Port au Prince. This work will be extended to other sections of the country as rapidly as funds permit. Included in this program are talks, lectures, demonstrations, and moving pictures. Gratifying, indeed, is it to witness the eagerness with which students, parents, teachers, and the press are becoming interested in the cardinal principles of hygiene and sanitation.

D. Health centers.—In March of this year Haiti witnessed the opening of its first health center. Located in the heart of the capital city and adjoining the National Cathedral, a very prettily parked

and attractive 2-story building has been developed for this useful purpose. Here are located the following units: Office of public health officer of district of Port au Prince, infant welfare, prenatal and dental clinics, Museum of Hygiene, and a very nice photographic laboratory. The center is being developed also for training purposes, and within the coming year selected doctors and nurses in the various districts of Haiti will be brought to Port au Prince for special training (one to two months) and then returned to their respective districts for development of similar work there.

The value of such a program for any country is obvious to all. Our aim in particular is to improve the physical and social condition of the children of Haiti. No one has voiced the true significance of such work better than President Hoover, who, in a recent address, commented as follows:

The greatness of a nation, its freedom from poverty and crime, its aspirations and ideals, are the direct quotient of the care of its children. Racial progress marches upon the feet of healthy and instructed children.

SPECIALIZATION IN THE NAVY

By H. W. SMITH, Captain, Medical Corps, United States Navy

With whatever misgivings certain individuals may view the amazing growth of specialization within the Navy, its development has been inevitable, it being the natural consequence of enormous increments to our knowledge concerning means for prolonging human life; and so long as the amount and range of pertinent information continue to increase, so long, it now appears, must the process of specialization go on.

This tendency is not confined to medicine alone. Ours is a period in which all forms of human activity display the phenomenon of specialization to an unprecedented degree. Whether for better or worse, we are of that period, and it is inconceivable that we, alone of our generation, should cast off association with the intellectual movements of our times, willfully turning our backs on current trends and ignoring advances in the contributory sciences.

In fact, so evident is the virtual necessity for specialization—and, by and large, its desirability as well—that specialization has spread year by year as rapidly as the adjustments incidental to the revolution in practice have permitted. Tacitly accepted as a universal and apparently unavoidable condition of progressive development, it is ineradicably established.

There being thus nothing to be gained either in supporting or in opposing the principle of specialization, I may go directly to two interrelated subordinate features which are still subject to control

and concerning which there is still active difference of opinion. They are:

1. Should specializing be preceded by a period of general practice?
2. May exclusive specialization be allowed?

With regard to the preparatory experience to be required of men prior to their selection for formal launching on a career of specialism, many observers are of the opinion that no one should be permitted to enter on the practice of a specialty until he has acquired at least a fair amount of experience along "general" lines. I, too, so argued in an editorial that appeared in the *BULLETIN* (Nov., 1922, p. 813); but now I am not so certain that the position then taken is either sound or practicable. On the contrary, I am rather inclined to believe that specialism should be adopted early and not made contingent on previous "general" experience.

I have come to perceive that with us the natural order of development, once the inductive period is completed, is from the special to the general. Our prescribed naval organization is such that the junior officer has a ward, the senior a service, the coordinator a hospital. The trend as a man ascends in rank is toward supervision and hence generality. Decidedly, it is the older men who exercise daily the more inclusive knowledge and the broader experience.

This order of development, being in fact the one we now follow, is obviously practicable, and it appears to be also reasonable in the feature of requiring that mastery of one subject precede mastery of several. Often, however, it is criticized for this very feature, it being alleged that the practice evolves specialists on whom a hopelessly narrow outlook has been fastened by too early specialization. This criticism is so commonly voiced that its groundlessness should be pointed out and emphasis laid on the actual fact that intensive study is not only compatible with extensive study but is actually impossible without it; for the term "specialist," while it has reference primarily to the mastery of some special technique and the possession of much detailed knowledge in relation to some one subject, connotes the accumulation of a large associative experience. In no case should it imply intellectual confines.

For example, the specialist in tuberculosis ought to be able to interpret chest röntgenograms; to be familiar with the laboratory diagnostics of that disease; to know not a little pathology, bacteriology, immunity, and serology; to know enough practical surgery to drain an empyema; to comprehend the principles of metabolism and dietetics; and to recognize all conditions that are likely to complicate tuberculosis or in any way influence its course. A urologist presents an example from his field: "In the selection of the time and method of operation and the type of anesthesia the surgeon must

attach even greater weight to the condition of the cardio-vascular system than to the condition of the kidneys. The surgeon must understand the essentials of cardiac physiology and therapy if he would give his patients who undergo prostatectomy the best chance to survive."

Again, a surgeon must be able to differentiate empyema and pneumonia, duodenal ulcer and tabes, intestinal obstruction and abdominal arteriosclerosis, Buerger's disease and diabetic endarteritis, and must be able to estimate the degree of cardiac, hepatic, or renal adequacy.

Thus we see that breadth follows pointed application as surely as the base of a wedge follows its sharpened edge. Allbutt expresses the same idea in speaking of this obligation imposed on a specialist: "He must take all else into his special field." Certainly, the conclusion is that a man can not become a capable specialist without being compelled to acquire incidentally a vast fund of collateral information.

There are, however, so many able and experienced officers who believe that a period of "general practice" is a necessary preliminary to entering on the practice of a specialty that I shall examine at some length into the nature of the probationary occupation recommended.

One hears such frequent references to the general practitioner of olden times, always with the implication that in him the ideals of medical practice reached full flower, one may be excused for suspecting that he, like some other ancients, has been exalted to become a fetish with us; for there is much reason to believe that he was the wise physician rather than a good internist, manifesting in his practice a benignant influence upon the troubled human spirit rather than exhibiting skill in discerning and eradicating disease entities, in this matter being clearly at odds with his successors of the "pathological" period, although quite possibly none the worse physician for that. At all events, the fact is that the absence in former times of methods of precision, of exact knowledge, and of accurately full records prevents us from estimating with any sureness just what the old-school practitioner did actually accomplish, so that he remains a vague figure obscured by remoteness and sentiment.

Nor are we much better off in respect to our ability to judge the practitioner of our own day, because with him also the lack of exact data makes hazardous any generalizations concerning the kind of experience gained in general practice and its extent. That being the case, it is fortunate that dubious generalizations are not required, we being in a position to draw conclusions as to the value of his experience without knowing precisely either its kind

or degree. For, whatever the nature of this, or any other form of personal knowledge, it can be utilized by an individual for his guidance only in so far as it has been transmuted into conscious judgments; and the possible value of such conclusions is necessarily limited by the accuracy of the basic data entering into them and the manner in which the data have been handled. Now general practitioners are like most individuals in displaying conspicuous inability to extract the essential elements of a situation; and even if their primary data were accurate and well handled, the paucity of material of any one kind in general practice makes the formation of conclusions slow and dependence on them dangerous. In brief, then, it will usually be the case in general practice that facilities for observation are poor, capacity to observe slight, and errors in inductive reasoning common. Consequently, general practice is poor schooling.

Others, while admitting that modern, scientific medicine is not to be learned in general practice, lay emphasis on the experience to be gained in the "art" of medicine; and one writer has stated that "the art of medicine can be practiced even though the science of medicine is not available just around the corner."

Properly the "art" of medicine is to be regarded as the skill exhibited in handling to good purpose all the elements contributing to the condition in which the patient finds himself, the meaning of the term "practice" being then restricted to denote dealing with facts and observations pertaining to specific morbid entities or states. Medical art, so defined, is the highest expression of medical practice and will later receive extended consideration from this point of view.

It is true, however, that the art of medicine in daily operation is observed often to involve the use of intuitive faculties and the exercise of personal influence on the patient to the virtual exclusion of scientific investigation, a manner of proceeding that may occasionally be necessary, owing to defects in current knowledge, but which is defensible only so far as it is concerned with factors believed contributory to a morbid state which are indefinable, or immeasurable, or not definitely known to be operating. For the art, unless rigidly restricted to factors such as those enumerated, is liable to degenerate into a shrewd catering to faith, clever support to morale, and symptomatic therapeutics. Indeed, in general practice the art may become so interwoven with psychic artifice and artful assumption of credit where none can rightly be claimed that undue familiarity with the technique early in a professional career may be subversive to youthful ideals of honesty in dealing with one's fellows, and confusing as to the means to success in life.

Although such petty skill may prove on occasion a valuable resource to an individual, sustaining him in crises when better supports are lacking and enabling him nevertheless to emerge with credit, yet it is a potential danger. As is the case with stimulants and narcotics, it becomes easy to call on such aids, eventually to the neglect of other and more substantial resources, so that one almost fears to countenance familiarity with such an expedient. Certainly success by dependence on such methods is such a dangerous example to set before beginners it should not be made an immediate objective in their training.

Fortunately, opinion as to the practical value of general practice need not be made to hang solely and entirely on the plausibility of such argument as may be advanced, since in the past we made actual trial of a system sufficiently like that now urged to permit us to draw on the experience. I refer to the system of medical education in force when the general practitioner was the medical school. Was the system good? William J. Mayo declares that the graduate nurse of to-day knows more than did the family doctor of 50 years ago. If in the course of generations general practice was able to show among its practitioners no greater knowledge than is implied in that judgment, it seems hardly worth while to look further to that field as furnishing conditions suitable to enlighten our young men and to shape their ideals.

One alternative often suggested for young men, as better than a period in either archaic general practice or exclusive specialism, is the "rotating service," an arrangement under which an officer serves as assistant in each of the several specialties in succession. But when one enumerates the specialties, it becomes at once apparent that the shortness of the time he can spend in any one forbids his acquiring any useful knowledge of any. Nor will he, in a kaleidoscopic sequence of activities, have a better opportunity to create by synthesis the broad philosophic conception of the human organism that is set up as the object of such varied experience. On the contrary, the victim of such mistaken methods becomes the dilettante, flitting from subject to subject and amateurishly ignorant of any. Under such a system we would lack good apprentices, and soon we would be without masters.

As a matter of fact, circumstances result in most of our younger men getting experience in several specialties pending their encountering some directive influence that carries them into some one pursuit. Such experience is often described as "general"; but so far from being that, it really consists of successive periods of work in a few lines as assistant. After a variable period of service, then, in one, two, or possibly three specialties, under specialists,

he sets his course toward his chosen goal, invariably chosen because that is the one subject of which he has acquired some degree of conscious mastery. Succeeding internship with such haphazard and abortive employment interposes in a man's career a period representing only so much time lost, except so far as the Navy needs somebody to do ward work, and except so far as this pause may be required for certain men to find themselves, or for others to find them.

Another phase of the question as to when education in a specialty should begin is contained in the axiom that to be a specialist one must have specialized. It is clear from published articles and from conversation that even those most opposed to the principle of unrestricted specialism state unequivocally the necessity for "some" specialists to serve as chiefs of service. I am unable to understand how they who hold this view can admit so much and yet ignore indispensable precedents. Unless training is going on in every quarter, there can be no opportunity for officers to acquire the requisite professional skill or for their superiors to exercise discriminating judgment in making selections for further development and for responsible positions. As well might a college coach on October 1 lay apostolic hands on 11 bystanders and inform them that henceforth they constitute the varsity team.

The necessity for early application to specialized training is made evident by a table which represents fairly, I believe, the usual apportionment of time in the career of a naval medical officer:

Period	Occupation	Age	Years	Per cent
Preparatory.....	Student.....	19 to 26	7	16
	{Apprentice.....	27 to 32	5	12
Operative.....	{Specialist.....	33 to 42	10	24
	{Chief of service.....	43 to 52	10	24
Advisory.....	Administrator.....	53 to 62	10	24
Total professional life.....			42	

Of the 15 years allowed for apprenticeship and active specialized practice, one-third will have been spent at sea, there remaining only a possible 10 years in which to acquire that degree of skill, experience, and authority indispensable in one about to become a chief of service. That span, the maximum obtainable under a system encouraging exclusive specialism, being if anything all too little, it follows that any plan which lessens the time which can be devoted to special training results in preparation correspondingly less adequate.

In all the cry to learn general medicine prior to taking up one subject, I am reminded of a story said to typify the attitude Agassiz

sometimes took toward overambitious students who wanted to learn "all biology" first and then "some biology." In such cases he was in the habit of exhibiting a frog and saying to the usually young man, "When you have learned all there is to know about this, come back. Good day."

I can picture the student confronted with the goggle-eyed batrachian, slimy and warted, but holding within its squat confines the keys perhaps to all the secrets of the universe. The more the magnitude of the problem unfolded itself, with ever-receding limits, the more, I suspect, did the student wish he had sought to capture biology with less ostentation, seeking to enter by some obscure wicket rather than take her entire and at once by storm.

To sum up: "General practice" does not constitute to-day good fundamental training for men intending to enter a specialty. On the contrary, representing as it does an attempt to practice all specialties without adequate preparation for any, it works permanent harm to an individual in that it sets bad standards of practice, thereby making men tolerant of low ideals and wanting in their sense of obligation to patients; for in so far as there is available that exact knowledge on which reasonable action must always be based, the physician who voluntarily proceeds without it is faithless to his trust.

In this day a general practitioner is to be regarded as a makeshift, a substitute for something more desirable but economically or geographically unobtainable. He is not an ideal toward which we should shape our juniors, nor is his occupation such as to offer us much educational value. There remains, then, no recognized field in which a man can get a comprehensive training except his own; for conditions of medical practice are such that development must proceed from the nucleus of a specialty, growth continuing by expansion and accretion, until we approach, though by a reverse process, the ideal of the proponents of the "general" man. The conclusion is that we should start men early in a specialty whilst yet their ideals are fresh, their ambition strong, and their standards of service uncompromising.

As to how far specialism may be exclusive is debated as freely as the matter of preparation for a specialty. While no one will dispute the general dictum that higher professional training is always desirable, there is difference of opinion as to how universal advanced training may be made, and as to how far it may be carried to advantage in the case of individuals. Some observers believe it necessary to our standing as a corps that we be prepared to give medical service equal to that obtainable anywhere; others believe that we can not cultivate special training to an effective degree without so

narrowing a man's range of attainments as to disqualify him for service in a military corps.

It is argued by these latter that there is rarely reproduced in the service the situation obtaining in every large civil community where the availability of other specialists permits restriction of one's own practice. Except in and near our larger hospitals, our situation is usually, they say, that confronting the physician practising in remote rural districts, and consequently preparing our men for independent duty should be our first concern. In doing otherwise, i. e., in attempting to develop men who shall rival the more noted of our civilian brethren, we are embarking on a course that entails great administrative difficulties and one that will keep many, perhaps most, of our best men in one line of work until, other interests atrophied from disuse, they are unfitted for "duty as medical officers."

Of those medical officers who have expressed such views publicly, most, when faced with choosing between specialism and "universalism," have avoided the dilemma by grasping both horns. They have argued that a specialty should be a tower erected on a broad foundation of general medicine; or, as is said of lay education, medical education should embrace first something of many subjects, and then much of one.

As stated above, I doubt if that position can reasonably be taken to-day. Medicine has so evolved, for well or for ill, that it is split up into subdivisions which may be likened to a string of beads—all having a common bond in the human body, but each organically separate. Together, they cover a range so vast that human limitations deny even to the most industrious proficiency outside one field. "The genius of unimaginable powers who is to weave this great welter of . . . facts into a consistent, understandable fabric is yet to appear." So the commentator of to-day can fall back on no such easy way out as straddling his thesis. Since the two alternative conclusions have become mutually exclusive, events compel him to make a choice. He has no escape from either exclusive specialism, or none.

But whichever his immediate conclusion, he does not finally escape specialism, because, as I have pointed out, there is no longer that form of practice vaguely denoted by the term "general."

That general practice is no longer what its name implies has become so clear in our day that many prominent and responsible educators have urged recognizing it for what it has in fact become, a specialty in itself, and they advocate giving specially arranged courses in medical schools for those who elect it. Indeed, the view may well be held that all practitioners of medicine are specialists

whatever the name applied to the particular form of practice followed, since they select and apply for a particular purpose items of knowledge culled from many so-called fundamental and contributory sciences. It is true of all lines of intellectual activity, even of the pure sciences, as in the case of astronomy which utilizes mathematics, physics, chemistry, photography, and mechanics. But even if general practice be regarded as literally general, the fact remains that medicine has become so split up into its constituent elements, each with its own canons, that general practice is in reality the practice of many specialties by one man; and the question at issue still is whether we shall have our officers each able to do one thing well, or nothing well. Most will admit it better to acknowledge that our most capable men are inexperienced in certain lines than to confess we have no man in any branch who may be described as capable according to standards current in civil practice.

The one field that is still broadly inclusive and so the one apparently adapted to turn out men with the general experience to be required prior to embarkation in specialist work is that of internal medicine. But, whatever the practice of internal medicine may once have been, it is now itself a specialty. It is, moreover, a terminal specialty, representing a culmination and not a preparatory stage; so that when a man has done the work requisite to be a good internist it is too late profitably to start him afresh in regional or technical specialism.

Moreover, inasmuch as the internist weighs and integrates information submitted by his several specialist associates, thereby assuming the act of decision and the burden of responsibility, specialists are and must remain functionally subordinate. In all likelihood the internist would not willingly relinquish his position of arbiter to play a minor rôle.

I speak of an internist as an arbiter; he is that, but equally is he a broker, an intermediary, dealing with pieces of paper that his confidence in his several specialist consultants leads him to assume represent actual conditions; but of the authenticity of the facts in hand, or the means by which the supposed facts were ascertained, he has no personal knowledge. In large part, then, he has become separated from the patient and unable to operate except through intermediaries—decidedly poor training for the solitary general practitioner.

However, in all this I feel that we are combating a straw man of our own erection. Exclusive specialism need not, as is constantly implied, unfit a man to function as a medical officer afloat, a person who, because of his isolation, has to comprehend within his practice all things medical. To revert to what has gone before, we need to free our minds from the delusive spell of foundations, bases, and

pyramids, in order to realize clearly that specializing is more properly pictured as a process of expansive development. It may be likened with more truth to a river, fed by innumerable streams, growing deeper and wider as it flows onward.

I take it that the relationship of the specialist to the whole field of medicine is not essentially different from that obtaining between a musical performer and the whole art of music. In each case there is specialism imposed by the necessity of mastering a technic, for the attainment of which long apprenticeship and arduous practice are required, this resulting in performance being restricted to one instrument. But when the performer becomes the conductor or the composer, it is not necessary that he have mastered all of the many instruments in his assemblage. Indeed, he need never have laid hands on more than one or two; yet his ability to marshal the varied contributions of the many instruments to serve a common end is not thereby impaired. Note—and this is my point—that the performer, to become the conductor or the composer, progresses from the narrow limits of his own instrument into the broad field of musical art, the progression being from the particular to the general.

It is so in medicine. The physician need not have practiced every specialty, or even more than one, to have acquired a broad knowledge of the healing art and conspicuous ability to extract a diagnostic conclusion from an array of individual and apparently unrelated facts.

Whether or not my simile of a river, or my analogy from music, represents truthfully conditions with us, it will be agreed that the alleged restrictive effects of specialism will be felt only in certain stations. In hospitals there will always be an internist and a surgeon who, as chiefs of service, can and should act as coordinators. They it is who conduct the general examination which should precede reference to a specialist, and who review the findings submitted by the several consultants. It is where such experienced men are lacking, as on shipboard and at small stations, that we might feel the effects of failure to provide more general training for all men.

This is indeed the feature of service most often mentioned as constituting a condition which makes exclusive specialism impracticable for us—namely, that a medical officer on shipboard is necessarily, by reason of that circumstance, thrown entirely on his own resources and must therefore be qualified to meet any situation that may arise.

The situation has been pictured as follows: "A naval medical officer may be on a ship a thousand, or more, miles from a hospital. An emergency may arise requiring immediate operation. It may be an acute abdominal condition or, again, it may be a mastoid infection. Circumstances like these require that every medical

officer shall be a surgeon as well as a general practitioner." It may be desirable that every medical officer be equipped to meet any surgical emergency, but it seems equally desirable to have him prepared to diagnose and treat glaucoma, to recognize an empyema or ringworm, or—even more important—a positive throat culture, an inedible fish, or a malarial mosquito. Thus we are led to the naïve position that a naval medical officer must know everything.

The desirability of having available on occasion men "qualified" to meet any emergency does not make any attempt so to qualify all men any the less futile. Dismissing, however, questions of practicability, before accepting the fact that there are occasions when officers are remote from all support as compelling us to a particular course of action, it may be worth while to ascertain just how generally the condition obtains, lest we permit what may be a rare occurrence to have undue weight in determining policy. If, as will appear, the sea requirements of the service are minor to a degree, it would seem that they need not be allowed to set our standards and govern our aims.

The actual figures in detail which would represent faithfully conditions of service in this respect are so difficult to compile that I have not tried to attain literal accuracy, but I think that my figures may be accepted as sufficiently approximate to illustrate my point.

Of our 709 medical officers at date of writing (exclusive of internes), 75 per cent are in situations where naval specialists are available. In the case of the remaining 25 per cent, of the 12 months each year passed technically as "at sea," not less than 10 months are spent at a yard, or attended by a hospital ship, or at anchor in company with other ships. At such times other officers are available for consultation, and among them all specialties may be represented.

It appears, therefore, that, in the aggregate, not much more than 5 per cent of the medical service of the Navy is rendered under circumstances such that the medical officer is in fact thrown on his own limited resources.

The preceding computation obviously refers to the time element. Calculated on the basis of sick days the result is not essentially different; for, so measured, it develops that less than 9 per cent of the work of the medical department is carried on aboard combatant ships. Either set of figures constitutes a reply to the statement that by suppressing specialism we shall be acting with a view to the greatest good for the greatest number. When one considers the general ability possessed by our appointees it does not seem obligatory deliberately to lower the plane of ninety-odd per cent of our service in order to attempt, with doubtful prospect of success, to raise the level of the small remainder. Because, at some time during a tour of sea, a man may be called on to display some knowledge of any

branch of medicine whatsoever, it does not follow that he and all other men also must needs be sharply restricted in their attainments, and made to spread the sum of these attainments over so large a field that it becomes uselessly tenuous. A small amount of gold may be beaten out so thin as to cover an amazingly large area, but it does not then serve any useful purpose in daily life. Indeed, the process may rather be thought of as a cheap device for glossing over the real lack of fine metal. Superficial knowledge of many subjects may similarly be viewed as a fine cloak concealing essential ignorance.

In this connection I can not let pass unchallenged the implication frequently presented that specializing necessarily operates to unfit a medical officer to function as a ship's surgeon, or even to diminish his efficiency. . . . It is said that, when thrown bodily into the water the child swims. Ordered to sea, the medical officer may not react in such purely reflex manner, but he may be expected to mobilize all his latent resources to meet the situation in which he finds himself. He brings to his aid his reserves in casual knowledge, calls on his stock of collateral information, lays in supplies of relevant material by reading, exercises innate common sense, and . . . functions as a naval medical officer. Experience proves this to be the case. In general, our best ship's surgeons are recognized specialists.

Those who maintain that specialism should be restricted to a few, and then never to be exclusive, on the grounds that military service is itself a specialty, appear to conceive a military surgeon as a general practitioner who has acquired by association some knowledge of the special conditions under which his work is carried on, and who perhaps has filled one or more positions having duties peculiar to a military organization. Such statements in fact carry the curious implication that practicing all branches of both general and military medicine is somehow "specializing."

Ignoring the paradox presented, I can see no reason for laying down that a military surgeon must, after the completion of his basic medical education, be a general practitioner. There may have been some warranty for that idea in the remote past when the active Navy consisted principally of solitary ships scattered over the seven seas, and before the science of medicine had developed its modern characteristics; but to-day a policy of general practice for all would be as archaic as the ships with which it was contemporary.

If the term "military surgeon" is to have a strictly specific connotation, its application should be restricted to persons engaged in activities which require medical knowledge, or which deal with medical elements, peculiarly associated with the waging of war. An example is the medical officer exclusively occupied with medical aspects of gas defense. But the medical and military duties of a

medical officer are for the most part too closely intertwined to permit distinguishing him on the basis of his military duties; and the only universal characteristic that will serve in definition is the aim common to all activities whatsoever of all military surgeons.

The term "military surgeon" may be accurately if broadly defined as denoting one who has engaged himself to perform on occasion any of the duties that may properly be required of a medical officer as a member of a national military service; and the term is to be regarded as representing an allegiance rather than a specific occupation. It does not then so much represent performance of duties of any particular nature; rather is it a dedication to the work of furthering in some way pertaining to the profession of medicine the military aims of one's country. It is to be remembered, too, that ". . . Armies and navies are not battleships or tanks, airplanes or submarines, guns, bombs, or torpedoes. They are men—using the best weapons and vehicles available to gain and maintain physical occupancy of disputed territory for themselves, and to deny it to the enemy . . . " (Leighton). Thus it is evident that a medical officer wherever on duty may be doing his full part toward making the Navy effective. From this point of view, the aurist or helminthologist is as truly a military surgeon as is a "ship's doctor," or one specializing in aviation, diving, field service, or supply. Each in his own place, after his own fashion and according to his capabilities, is contributing to the accomplishment of the mission of the medical department.

While the naval medical officer must acquire certain items of information of which his civilian confrere has no need; while he must have a degree of familiarity with naval aims, traditions, and practices; and while he, on occasion, in common with others "going to war," must often undertake strange duties; these and similar activities can not be said to constitute a specialty. Instead, they are features incidental to the realm in which the medical officer pursues his professional duties. Within that realm he may follow a specialty peculiar to it, as chemical defense, or a specialty common in all our civilian communities.

As to whether specialization may impair an officer's ability to assume directive control in time of war, intelligent men can not serve for years in a naval environment without acquiring, perhaps casually, perhaps by purposeful application, a familiarity with the traditions, methods, customs, and ideals that enter into the operation of a navy. Consciously or unconsciously, the process of indoctrination proceeds; so that an officer, whatever his past occupation, who has reached a grade appropriate to military or administrative duties, has at the same time become capable of undertaking them.

Even if I am in error in thus minimizing the importance to be allowed general practice in the Navy, and in all else that has gone before, I nevertheless remain convinced that our specialism should be exclusive and followed by as many officers as circumstances and diversities in personality will permit. The main consideration determining this belief is that only with the aid of capable specialists can we discharge our obligations toward our patients. In this matter there is hardly occasion for debate. From the Bureau files it can be shown that not one responsible head of our naval hospitals believes he can discharge his plain duty to his patients without a staff of specialists of experience. For example, the commanding officer of one hospital maintains that he can not carry on with less than 14 men—not beginners, but men who have “arrived.” In brief, it is agreed, tacitly or otherwise, by those most closely in touch with current practice, that we can not practice medicine to-day without genuine specialists, and they, to be worthy the name, must have had so long apprenticeship that exclusive specialism is inescapable.

As throwing a side light on the question, let me refer to the “end-result system,” a requirement for hospitals seeking recognition by the American College of Surgeons. The purpose of the system is to insure the welfare of the patient through the application of exact methods to clinical study. Essentially, it is a system of audit.

It is fair to anticipate that under such a system a commanding officer, having available a means of ascertaining the quantities of officers, in precision superior to impressions, beliefs, and prejudices, would be quick to relieve a man if his results were proving to be not satisfactory; and similarly, medical officers knowing their work to be measurable and known to all, would be slow to undertake work for which they felt themselves ill prepared. More and more would each class of work come to be done by those specially and well trained to do it. This effect is observable in hospitals where, following a study of end-results, there have been established special services.

Thus we see that a system designed to safeguard the interests of the patient brings in its train exclusive specialism. If we truly believe that the welfare of the patient should always be the first concern of the physician, superior to professional ethics or esprit de corps (although in fact the interests of the patient and that of the profession are in the long run inseparable) we must conclude that specialization is of right our goal.

From another quarter also are we coerced to specialism. Following demobilization, we were literally unable to secure candidates for appointment in the medical corps, although the vital importance of a constant succession of “fresh blood” was recognized, and every

effort made to induce desirable young men to enter the Navy; and it was not until the interne service was instituted in our hospitals that recruitment up to strength was attained once each year.

To be recognized officially by State boards, the American Medical Association, and the several universities as qualified to undertake interne training, our hospitals must meet certain specified requirements as to specialist service; and unless we have specialists, qualified and so designated, in the number laid down, we shall fail of "recognition," and our only adequate source of recruitment be cut off. Moreover, can we fall so far short of our obligations as to permit a condition such that our hospitals would appear among those institutions listed as falling below the minimum standards tolerated in civilian communities?

While I advocate giving selected men the utmost practicable opportunity to remain in their chosen specialties as the only way of enabling them to acquire skill, experience, and authority, and while I urge frankly adopting measures to that end, yet the result of such measures will not be that we shall actually become a corps of specialists. Several causes will operate to limit the number of men able to specialize, among them lack of ability, initiative, interest, or opportunity; the latent period observed before most young men find their natural bent; and the diversified demands of the service. Hence, there will always be many who are not specialists and many others who will necessarily, as in our smaller hospitals, be combination specialists, combining for example, eye, ear, nose, throat, or urology, syphilology, dermatology, or X-ray physiotherapy. Therefore, although it is only by making widespread, exclusive specialism our aim that we can get specialists in the number and of the kind needed, we can never actually attain that goal, and there is no occasion to fear the results of the effort.

It may seem that my discussion has been carried on solely with reference to but one phase of our work, that of curative medicine, but I have had other activities equally in mind. We have men specializing in preventive medicine and sanitation, in aviation medicine, in chemical defense, in the hygiene of submersibles, in field service, in war plans, and in supply; and the list may be extended as required to include all the diverse duties that may be assumed by medical officers of the Navy. That I have not mentioned these specialties at length and individually is because they present no peculiar problem, what I have said regarding medical specialties applying equally to military specialties.

Someone has suggested that the adoption of unrestricted and divergent specialization deprives medical officers of any unique collective characteristic such as would justify the existence of a naval

medical corps, such a course making it apparently feasible to exchange personnel with other Government services, or even to replace with civilian specialists. Indeed, this was done during the late war, and was reasonably successful, medical specialists having been enrolled in large numbers and having given satisfactory service. It is the case, however, that the employment of civilians was strictly conditioned, they being always under the direction of medical officers sufficiently long in the service to have gained that indispensable working knowledge of naval organization, administration, tradition, and doctrine, in sufficient degree, to operate effectively as planners, coordinators, and directors. Hence, it may be accepted as demonstrated that the possession of experience of a kind not to be gained outside the Navy is necessary, and that such experience can be acquired incidentally to service notwithstanding the pursuit of a specialty.

Finally, the effect of permanent specialization as a morale agent should not be overlooked. Few things are so disheartening as successive shifts to work of a different character. A man may apply himself to each subject in turn with zeal; but eventually he sees that in every line his progress goes so far and stops. It is Sisyphean labor. Whereas, kept in one line of work, he experiences the satisfaction of progressive development; and that feature, more than any other, insures that interest will be sustained. Then, too, it is the specialist who commands prestige and deference, draws good assignments, obtains enthusiastic fitness reports, is certain of selection, and, in general, basks in the pleasant sunshine of commendation. In the service where no material reward follows conspicuous work, the recompense of reputation must be reckoned with.

In the foregoing it has been maintained that specializing need not be preceded by a period of general practice and that specialism may to advantage be exclusive, since thus there is utilized progression from the specific to the general, a process in harmony with universal habit and most effective in evolving a satisfactory product.

But it is not to be denied that specializing early and exclusively may bring in its train new evils to be feared. Hence, one can not properly advocate the practice unless prepared to suggest means whereby the anticipated evils may be mitigated.

The principal reason advanced for opposition to specialization, and one all too well grounded, is, in brief, this:

When extreme specialization prevails, then there is concurrent provincialism. Absorbed in his own little anatomical region, the physician attempts to diagnose and treat disorders, forgetful that they, or even the specific diseases, may be hardly more than the casual or late signs of deep disharmonies. No argument is needed to prove that proceeding thus without due regard to other functions

and parts of the body, and ignoring the many influences that may impair health, must prove ultimately disastrous to both physician and patient.

I having urged specialization, notwithstanding inherent tendencies that are undeniably bad, it may be asked what remedies have I to counteract the evils otherwise likely to develop.

The first and most important means of overcoming provincialism in medicine is to revise the educational program currently followed. The preparation required to practice medicine or any of its specialties comprehensively as will be urged must be broader than heretofore considered adequate; for, while preparation is often regarded as a purely utilitarian process of training, it is much more than that. Vocational training fits men to follow standardized procedure, but it does not equip them with the ability to define and solve new problems.

When I speak of medicine as being more than a technic, a liberal profession demanding insight and imagination in its practitioners, it is not to be understood that I am presenting these qualities as materials of a science, else would medicine revert to the scholastic empiricism of its past. Rather do I mean that the free exercise of these faculties is indispensable to progress. We ought never to permit ourselves to lose sight of the essential value of the general over the particular, of truth over fact, of principle over skill. A student so schooled goes faster and farther. A British General Staff officer is quoted as saying that "An officer who knows his * * * Xenophon is more useful in war than one who knows his army regulations." Implanting this truth is preferably perhaps an item of early education while habits of mind are yet in the forming, but if not already learned it is equally to be taught in adult life when broad vision is most needed to sustain interest and incite to unflagging endeavor. Our men should be armed against that period in life when routine palls and when continuance of useful and pleasurable activity depends on the possession of habits of inquiry and reflection that discover fresh problems in each day.

If it is insisted that laying a foundation must precede specialization, let the preparation be cultural. By this I do not mean necessarily a familiarity with dead languages and aesthetics, but more particularly a familiarity with the studies that are the tools of an intellectual trade, so that there shall be acquired the object of such studies—a training which shall have inculcated habits of observation, reflection, analysis, and deduction; in other words, the possession of faculties trained for intellectual pursuits.

Flexner is quoted as stating that "if medicine accepts as its goal, however remote that goal may be, scientific standards alike in research and in practice, medical education must be conceived as pri-

marily the effort to train students in the intellectual technique of inductive science," and McLean, with the same idea, declares that "The first duty of the university is to shift the emphasis from subject matter to the intellectual processes of the student."

"The doctor differs from most other craftsmen because he is expected to discover the scientific laws underlying his craft as well as to apply them in practice. . . . Therefore medical education must be planed on broad enough lines to give a common starting point for the researcher as well as for the practitioner. Nor is the role of the practitioner at any time so completely separated that he may not, whilst engaged in practice, make discoveries that place him among the researchers." (Nixon.) Admittedly, of equal importance with the discovery of new facts, is the coincident critical examination and possible revision of current fundamental concepts—the function of philosophy. Education is as necessary as training.

Cultural, humanitarian, and even fundamental subjects would perhaps not be necessary if the training of men could ever be certified as complete; but so long as knowledge is growing, thus requiring basic education in order to encompass novel conceptions and absorb new apprehensions, so long is education in the fundamental subjects necessary—proficiency in the universal logic of science. An example will serve to illustrate how a dominating preconception, or a basic flaw in the process of orderly thought, can bring to failure a lifetime of earnest endeavor. Although for 40 centuries observations had forced men to conceive a spacious universe in which sundry globes, ours among them, pursued appointed paths, yet, when Copernicus set himself to the task of proving the truth of the idea mathematically, he remained unable after a full 30 years of unremitting calculation, because he was obsessed by the scholastic preconception that their orbits must be circular; for, as he argued, the circle being the perfect curve, God could make no other; hence, His heavenly bodies must travel in circular orbits. . . . To be able to observe minutely and accurately, and to reason flawlessly uninfluenced by prejudice or authority, is indeed a priceless gift.

In the absence of adequate training in the use of the universal intellectual processes, there always threaten two dangers—on the one hand, too ready acceptance of plausible surmises as the basis of action, and, on the other, undue resistance to everything new even when recommended by reasonably conclusive evidence as to its value. Medical history is cumbered with examples of the sterile pursuit of speculations, and also of the persistence of dogma as a fetish long after progress had rendered it untenable.

The value of habits of orderly thought can not be overstated. There is so little either definite or definitive in medicine, and even when views have crystallized the need for judgment in applying

those views so dominant, that the training of the medical man must ever be superior to filling him with currently assumed facts. Learning the nature of science and acquiring knowledge of its governing principles are infinitely more valuable equipment to a man aspiring to accomplishment than acquaintance with individual phenomena. Observational power is indispensable as furnishing the raw material; but it is reflection and imaginative reason which treat this material, transforming it, and evolving from it conclusions and hypotheses which represent ground of attainment that is solid and fit to serve as a base from which to project further advance. Culture gives the means of dealing effectively with any problem, for the tools of the mind are not changed with the objective material.

All this is not without a practical bearing. While the diagnosis of recognized entities is hardly more than the fitting of an assemblage of facts to a standard matrix, involving no necessary process of thought, in practice it is the exception to encounter well-defined entities conforming to description; disorder is the rule; and hence it is usually the case that inductive reasoning must be employed if an adequate diagnosis is to be achieved.

"Just in the degree which . . . (a physician) subordinates the individual case to some classification of diseases and some generic rule of treatment, he sinks to the level of the routine mechanic" (John Dewey). It is the discerning application of science to meet the needs of the individual patient that constitutes the art of medicine.

The revision of the medical curriculum that will necessarily ensue from the altered estimation of the values to be accorded its component courses may be illustrated. It is generally admitted that about one-half of all persons seeking medical advice have no causally associated lesions demonstrable at the time or subsequently. It is also not to be denied that in the onset, course, and treatment of demonstrable pathological lesions, the question of psychic states may be reckoned, in medical practice as a whole, as equal to all other elements of morbidity combined. In other words, in equipping men for the practice of medicine, in order to secure that balance of the essential components of good training most conducive ultimately to effective ministrations to the sick, about 75 per cent of the time devoted to the training period should be occupied by psychiatry, or allied subject matter.

Alterations in the aspect of medical practice in succeeding periods are transitory resultants of innumerable discoveries in fact and of advances in conception; and, like social movements in general, for the most part they unfold themselves by a process so gradual and so little the result of individual determinants, that we find it convenient to regard such changes as the product of undefined intrinsic forces.

Occasionally, however, the transition is accomplished so rapidly and appears as a so clearly defined phase that we are able to apply to it a descriptive name, derived from its chief characteristic.

The rapidity and completeness with which transforming ideas are propagated seems to be due to the fact that they have been of such character as to lend themselves to dissemination by our educational system; and it is to our schools we must look for agents to make the idea of personalism in medicine a part of our working body of thought if the change is to be brought about soon. Just as we have seen our earlier laboratory workers become educators, succeed in the course of a generation in molding our educational system in accord with their views, so we may expect their successors, trained to more liberal thinking, in turn to bring to pass a new era.

The second means of transforming the technical specialist into the wise physician is to keep steadfastly in view the essential aim of the profession, confident that then means will somehow be found to attain it.

That aim may be represented, broadly, as the duty of each physician to contribute as best he may to the maintenance in individuals of an ideal state we commonly term "health;" and to do this effectively his cognizance necessarily extends to all conditions that might affect the life of an individual. Hence, no thing relevant to human existence lies outside his purview, nor any factor of biologic import. In theory, at least, the art of the physician is coextensive with the universe.

Since acquisition of greater knowledge, the natural preventive of the narrowness that ignores this broad aim is precluded by reason of circumstance, limitation of intellectual powers, or the brevity of life, it is necessary to find a substitute for the unattainable omniscience.

In the editorial previously mentioned I spoke of the value of effective coordination in correcting the results of dispersive specialization, and I went on to urge the need of chiefs of service adapting themselves to serve as coordinators or integrators. The need is not less to-day. Biologists tell us that organic growth consists not only in enlargement, multiplication, and differentiation, but also, as indispensable for continued healthy growth, helpful interaction. So true does this seem to me that I can accept industry's estimate of relative values when I see its highest salaries paid to its executives. To apply the observation to our affairs, I am confirmed in my belief that the paramount function of our chiefs of service is coordination.

It is not enough, however, to create an office and to specify functions. It is necessary that we invoke as well an integrating doctrine

that will be adequate to restore conscious unity to a field now largely occupied by individualistic groups, perhaps indifferent to one another and at times actually warring; a force residing in the idea of our duty as outlined above—namely, the restoration of the patient to perfect health, considering of equal importance potentially any and all factors influencing human existence. With such a motivating idea prevalent, specialties cease to be ends in themselves but merely so many tools for the work in hand.

This is the newer science of personalism (Brugsch) or individualism. It does not restore man to his one-time eminence as the object of creation; yet it does not recognize him as an emergent, making him superior to the parts of which he is composed, and to the hostile features of his environment. At least, he is no longer to be viewed as an inert tube in which a race of bacterial mites are disporting themselves interestingly. On the contrary, he is to be regarded as a complex, individualized organism of a high order subject to attack by a lowly but destructive element of environment, the issue of the conflict turning not only on the invading force, and the damage it typically succeeds in inflicting, but equally on all possible conditions that could influence resistance to the attack and subsequent recovery. In place of the domination of our minds by pathological processes, there is substituted the idea of "the patient"—the patient in all his infinite range of characteristics that together stamp him a unique existence. Disease should not be conceived as an entity, but rather the response of structure and function to environment.

Instead then of depending wholly on a coordinator, a point of view is to be planted and nurtured in each physician. His horizon is thus immeasurably widened, and the realization so gained of the extent of the true field of endeavor will effectually prevent his mind remaining shut in one little compartment of medicine. Just as the separateness of objects may be overcome without altering their individuality by giving them a common aim—as witness the voices in a chorus, or the sovereign States of a Commonwealth—so may the dispersive specialties be integrated without destroying them or sacrificing anything in them of value. In brief, I urge that a point of view shall be made the correcting force for the evils likely to attend exclusive specialization.

The plea for personalism is not novel. Quoting from an editorial recently appearing in the *Annals of Clinical Medicine*:

More than ever is the medical practitioner regarded as something much more than one whose business it is to diagnose and treat disease; he must also be a preventer of disease. Patients have evolved into clients; the physician must be a counsellor and advisor, not only as to physical and mental conditions, but as to ethical and moral as well. In its higher manifestations the profession of medicine is developing into a super-priesthood dealing with the

phenomena of life in their entirety. No other profession assumes so tremendous a responsibility. For this higher type of physician surely a broad cultural course is required.

Plato has said that "the office of the physician extends equally to the purification of mind and body. To neglect the one is to expose the other to evident peril. It is not only the body which, by sound constitution, strengthens the soul, but the well-regulated soul, by its authoritative power, maintains the body in perfect health." Socrates also: "There is no cure for the body apart from the soul—and the reason why so many diseases elude the physicians of Greece is that they know nothing of the soul"; and it is clear from the writings of Hippocrates and Galen and the traditions of Aesculapius that they, too, held similar views. In modern times the part played by visceral stimuli in molding personality and influencing conduct is well recognized. White and Jelliffe, for example, affirm that "The intellect, after all, is only a guide to conduct. The deeper motives that move men to action come from the realm of feeling, and if the symptoms are to be explained or understood, the emotional springs of conduct must be fathomed." White continues:

Disease can not of course exist of itself without there being a person diseased. Diseases do not exist outside the organism and invade it. Disease is what happens when the organism comes into conflict with some inimical agent, and the symptoms that arise are not signs of the presence of an invading disease, but signs of what is going on in the organism as a result of the conflict.

A scientific approach to the study of the human organism demands that the organism be studied as a whole, including the psyche and human social relations. The whole is greater than the sum of its parts, and the higher phenomena can not be explained in terms of the lower—that is, health and disease can not wholly be explained in terms of physico-chemical reactions.

Diseases are entities, but the results of the organisms coming in contact with inimical agents. Each problem, as presented by the symptoms, contains the indications for its own solution. Every disease is both somatic and psychic, and the symptom contains both a somatic and a psychic component; also, an environmental as well as an organismal factor.

It is unfortunate that such balanced views regarding the psychophysical unity of man have not always prevailed. It is apparent that ancient medicine, perhaps finding the mind more susceptible to its arts than was the body, directed its chief efforts toward the imagination; so that, in remote times as in contemporary barbarism we see the mind treated to the virtual exclusion of the body. In early Christian and medieval times, while the necessity of treating both body and spirit was recognized, the unceasing warfare of the church against "the flesh" resulted in establishing their complete duality to the degree of utterly divorcing the treatment of their respective ills, the therapy being correspondingly divided between the clerics and the physicians. In the modern period, the advance of our knowledge of pathology and etiology, together with per-

sistence of the medieval point of view, have operated in large measure to focus the whole attention of our profession on parasites and tissues. Current medicine, then, is at one extreme; the barbaric medicine man at the other; with classic Greece, as always, displaying her magnificent sense of equipoise. Since the evils of specialism are conspicuously present in any period that exhibits extreme and uncompensated development, with a return to a mean position we may expect to escape them.

Further, it is not enough that we accept man the organism as we find him. His total aggregate of genes definitely arranged constitutes his so-called "genotypic pattern." But it is believed that the genes interact with one another and with the substances about them over long periods, so that the phenotypic characters that emerge are distant and indirect results of these many interactions. Nothing is absolutely fixed or foreordained within tolerably wide boundaries. The genotype does determine a certain norm of reaction, but the results of reaction will differ according to the influences and substances reacted with (Barker). Hence we should promptly endeavor to rid ourselves of a pseudo-moral convention that emphasis upon hereditary and conventional make-up should be shunned as necessarily conducive to pessimism in therapy and to a paralyzing fatalism, and be free to concede to "constitutional" factors of morbidity also the place in the curriculum to which their importance entitles them.

Confident that such reforms will eventually establish themselves, I anticipate that in the future medicine will increasingly concern itself with the condition of the whole man. His resistance, his qualities of constitution, all his traits which make for good or for evil. It will occupy itself increasingly with the fascinating but difficult study of trends and tendencies, with the border country between the physiological and the pathological; and this will in its turn bring medicine more and more in contact with how a man thinks, acts, works and plays; in short, how he has his being.

Concurrently with this expansion of the field of medicine, we may expect a complementary advance in intensive methods, so that medicine, having acquired through exact quantitative knowledge the power of prevision, can act more effectually to prevent, or at least postpone, the ills that now affect us in adult life and beyond. A most important collateral result of such a development is that, with the profession consciously directing its activities in the light of such broad views, successively appearing phenomena of practice, such as preventive medicine, periodic health examinations, and socializing programs, fall naturally and easily into place in the existing order. It follows that, though the outlook of medicine will alter, its horizon will immeasurably widen.

And so, I take it, we need not be perturbed by a movement that is universal in our day and characteristic of our times; much less need we oppose its progress. We may accept specialization, and the ensuing specialties, without fear that medicine itself will be strangled by them, her children.

CLINICAL ANALYSIS OF 100 OPERATIONS UPON THE GALL BLADDER AND BILIARY TRACT

By C. M. SHAAR, Lieutenant, Medical Corps, United States Navy

This report is based on a study of 100 consecutive operations upon the gall bladder and biliary tract performed by the writer during the past seven years in the United States Naval Hospital, Boston, Mass.; U. S. S. *Mercy*; Chelsea Memorial Hospital, Chelsea, Mass.; Military Hospital and Evangelical Hospital, Santo Domingo City, Dominican Republic. The literature of this subject is so huge that one would hesitate to attempt a complete review. But it has seemed to me appropriate to mention briefly the history and recent advances in the diagnosis and treatment of gall bladder disease.

Calculi in the gall bladder were first observed by Gentile de Folingo, an Italian anatomist of the fourteenth century. We find that Fernelius (1497–1558 A. D.) observed gall stones on dissection, and Kentmannus, a contemporary of Fernelius, made a similar observation and described the various types of calculi. Among the early and other distinguished anatomists of the fifteenth and sixteenth centuries, who mentioned the presence of stones in the gall bladder, were Benivieni (died 1502), Vesalius (1514–1564), Berengario da Carpi (1470–1530), Fallopio (1523–1562), and Eustachius (1524–1574). It was not until these important discoveries were made that gall bladder calculi were mentioned in literature as one cause of jaundice. Among the early writers who linked these findings with the clinical picture of the disease were Schenckius (1531–1595), Willis (1621–1675), and Morgagni (1682–1771). Haller (1708–1777) gave a splendid description of gall stones and the pathological findings in the bile ducts and gall bladder.

But many years elapsed between these first recorded descriptions of the disease and even the suggestion of an operation for the relief of this condition; for it was not until June 15, 1867, that John Stough Bobbs performed the first cholecystotomy in a room on the third floor over a drug store at Indianapolis, Ind. It remained for Carl Lagenbuch, a German surgeon, to do the first excision of the gall bladder on July 15, 1882. Since that time the gall bladder has been removed more frequently than any other organ in the human body except the appendix. It is surprising to find that so common

a surgical condition as cholelithiasis was not treated surgically until this late period, and even the question of how the gall bladder empties itself had not aroused interest at that time. We find that pericardiotomy was performed 33 years prior to cholecystotomy in spite of the inherited superstition that the heart is the "central abode of life and the soul." But in the last two decades the advances made in physiology, pathology, diagnosis, and treatment of this disease, have not been excelled by any branch of surgery. It is interesting to pause a moment to note the prominent part played by American surgeons from the first cholecystotomy by Bobbs up to the recent discovery of cholecystography by Graham and his associates.

In reviewing the literature we find that four questions have given rise to much controversy and some still remain indefinite.

1. Does the gall bladder play a very active part in upper abdominal digestion?
2. If it does, what are its functions?
3. How does the gall bladder fill and empty itself?
4. Should the abdomen be closed without drainage after cholecystectomy?

Rehfuss believes that the gall bladder does not play a very active part in upper abdominal digestion. He states: "The lack of the organ in many animals and the comparatively unimpaired digestion which occurs in individuals who have been submitted to cholecystectomy bear out this view." Charles H. Mayo tells us "The gall bladder is present in most animals which secure their food from the surface of the ground. The leaf eaters, which are mostly antler bearing and cast their antlers yearly, have no gall bladder. Other leaf eaters, like the elephant and horse, also have no gall bladder. The pocket gopher, living continually beneath the surface, has no gall bladder, while the striped gopher, living beneath and feeding above, has one." The fact that some herbivorous animals have no gall bladder and that the system adapts itself to cholecystectomy is not a conclusive evidence that the organ has no important function. Why should the mouse have a gall bladder but not the rat, and the hen but not the pigeon? These facts are difficult to explain.

The two well-recognized functions of the gall bladder are the regulation of pressure within the biliary tract and the concentration and storage of bile by the absorption of water. It has been estimated that the bile in the gall bladder is ten times more concentrated than that found in the hepatic ducts. Its capacity is about 54 cubic centimeters, and the daily production of bile is estimated at about one liter. Sweet suggests a third function. He produced evidence which strongly suggests that the gall bladder de-esterizes cholesterol esters. It forms a substance which is necessary for the liver to use. This is sup-

ported by the fact that the blood from the gall bladder empties into the portal vein. Blond agrees with Sweet. He believes that the gall bladder absorbs the constituents of the normal bile and turns them back to the liver. Sweet believes that under normal conditions little or none of the bile which enters the gall bladder leaves it by way of the duct, but it empties by absorption. But we find sufficient evidence to prove beyond any doubt that bile passes out from the gall bladder through the cystic duct. Copher injected tetraiodophenolphthalein into a dog after ligating the common duct, and the shadow of the gall bladder remained for weeks. Whitaker, Sosman, and Edson, also Boyden, have demonstrated that a fat meal can reduce the cholecystographic shadow of the gall bladder to about one-tenth of its former size within 1 hour and 45 minutes. Other substances that have a similar effect are white of egg and cream, peptone, hydrochloric acid, oleic acid, oil of peppermint, concentrated glucose solution, and pituitrin.

In 1879 Gage demonstrated the presence of a sphincter at the outlet of the common duct of the cat. Oddi, in his research on various animals, confirmed these findings in 1897. He described the sphincter as an organ anatomically and functionally independent of the duodenal wall. Since that time, and especially in recent years, the relation of the gall bladder function and the function of the sphincter of Oddi has been a subject of considerable controversy. Demel and Brummelkamp agreed with Oddi and suggested that the gall bladder fills possibly as the result of an increase in pressure in the ducts caused by the closure of the sphincter of Oddi. C. H. Mayo supports this view. He believes that the gall bladder has control of its own cystic duct and the sphincter of Oddi; but he also states "The rolling peristaltic waves during digestion would constantly milk the common duct and aid in delivery of bile when most needed." But we must remember that the sphincter has been found in animals that have no gall bladder. Whitaker found that the gall bladder remains empty after the sphincter has been divided. On the other hand, Mann has shown that if the cystic duct is ligated and Bengal red is injected intravenously, it will appear in the gall bladder. This shows that direct excretion from the liver is another factor in the filling of the gall bladder. But the entrance of part of the dye to the gall bladder through the cystic artery must be considered also. These findings are very helpful in getting us closer to the method by which the gall bladder is filled. A more accurate knowledge and a closer view is still needed for the complete solution of this problem.

In an attempt to explain the method by which the gall bladder empties, Meltzer, in 1917, advanced the hypothesis of a contrary innervation between the sphincter of Oddi and the gall bladder. He stated that a dilation of the sphincter is accompanied by contraction

of the gall bladder. It was this theory that led Lyon to the belief that the injection of magnesium sulphate through a duodenal tube would cause drainage of the gall bladder. This hypothesis has very little evidence to support it. Sweet does not agree with this theory. He points out the acute angle of the cystic duct with the common duct and the Heisterian valves (described by Heister in 1782) as important mechanical obstacles which seriously interfere with the passage of bile from the gall bladder to the common bile duct. Auster and Crohn injected a solution of methylene blue into the gall bladder of a dog, opened the duodenum, irrigated the papilla with a 25 per cent solution of magnesium sulphate, and obtained a flow of bile, but not a trace of methylene blue. Compression of the bladder caused immediate appearance of methylene blue in the duodenum. Graham doubts the existence of a true sphincter of Oddi at the end of the common duct. Copher and Kodama state that a distinct sphincter can not always be found apart from the muscle fibers of the duodenum. Burget considers that resistance to pressure in the common duct is caused by the normal tonus of the duodenum. The peristaltic wave of the intestines is followed by reduced pressure and the bile escapes by a milking action and aspiration. He also states that too much importance has been attached to the sphincter of Oddi. Carlson agrees with this view. The fact that the common bile duct runs obliquely in the wall of the duodenum for a distance of 2 or 3 cm., according to Quain, helps to support this view.

Bainbridge, Dale, and others have described rhythmic contractions in the gall bladder wall. Graham does not agree with this view. He states: "Stimuli which cause violent contractions of other hollow viscera in the abdomen elicit no demonstratable response when applied to the gall bladder. This organ can be pinched with a clamp, incised with a knife, or touched with a cautery, without the least sign of a contraction wave of any kind." Electrical stimulation was applied to the gall bladder by Boyden and Whitaker. There was no evidence of contraction. A contraction wave was never demonstrated by cholecystography, although many observers have patiently watched through the fluoroscope. Graham explains the emptying of the gall bladder on simple mechanical principles. "The gall bladder is a distensible viscus which responds to increased pressure in the common duct by becoming distended. When the ductal pressure is suddenly lowered by a sudden opening of the intestinal end of the duct, there is an elastic recoil on the part of the wall of the gall bladder which results in the ejection of bile from the organ." He also believes that active muscular contraction plays a minor rôle. From these findings we must conclude that the emptying of the gall bladder, whether it takes place in a passive way, by active

contraction, absorption, or by contrary innervation, still remains unsettled.

Should the abdomen be closed without drainage after cholecystectomy? This is another question which has been the center of a most active controversy in recent years. The opinion is divided, both abroad and in America. In Germany we find Körte advocating drainage. He states: "He who is wise will stick to the drain." Enderlen is of a similar opinion. He tells the German Surgical Society that he has been reared in the fear of God and the peritoncum. On the other hand Pribam, in that country, advocates closure without drainage. Instead of performing the usual method of cholecystectomy, he uses the cautery to char the gall bladder mucosa down to the serosa. The latter is invaginated to close the gall bladder fossa. This method he calls mucoclasia. In France most of the surgeons still adhere to drainage, although many have abandoned the extensive tampons in favor of small drains. Hartmann is a strong advocate of this method. In England a similar opinion prevails. Moynihan writes in his book on abdominal operations: "There are surgeons who like to close the abdomen after removal of the gall bladder, and there are surgeons who do not. I place myself with confidence among the latter. I never close the abdomen without a drain, though in the days of my adventurous youth I often did so. The presence of accessory ducts, which are sometimes so fine that they escape notice, means that in 15 per cent of cases a drain is admittedly necessary. For if bile escapes from a severed duct into the peritoneum a disaster is not far away." In this country we find W. J. Mayo considers "a little drain is a comfort to the surgeon and sometimes a life buoy to the patient." Wangsteen considers drainage is imperative after cholecystectomy. On the other hand, Richter and Zimmermann strongly advocate closure without drainage.

The preoperative preparation of handicapped surgical patients suffering from obstructive jaundice is a valuable advancement that merits special mention. It has been shown repeatedly that the intravenous injection of 5 c. c. of 10 per cent solution of calcium chloride and the administration of glucose will reduce the danger of post-operative hemorrhage in cases of obstructive jaundice. While it has not solved the problem of hemorrhage in jaundice, it is the most dependable agent in use at the present day. Walters, of the Mayo Clinic, deserves the credit for the use of calcium as a prophylactic measure. But we must remember that Mayo-Robson was the first to use calcium in the treatment of hemorrhage associated with obstructive jaundice in the year 1894. Three years previous Wright recommended the use of calcium in the treatment of bleeding from various conditions.

Another valuable addition to our knowledge of gall bladder disease was made by Boyd. His histological, chemical, and spectroscopic studies and investigations of "strawberry" gall bladders have demonstrated the dissemination of cholesterol through the gall-bladder wall and the epithelial cells lining it. The yellow strawberry-like spots represent a combination of cholesterol ester with a fatty acid, and are true lipoid deposits. This suggests that gall bladder pathology of the "strawberry" type causes disturbance in cholesterol metabolism. This type of gall bladder disease was first described by Moynihan and it was appropriately called strawberry gall bladder by MacCarty.

The masterly work of Rolleston and Courvoisier and their valuable contributions on this subject are too well known to be taken up in this article.

INDICATIONS FOR OPERATION

Two decades ago indications for operation were confined to those cases with biliary colic and jaundice. Diagnosis was based on a careful history and a physical examination and only the most obvious cases were then recognized. The involved problems of diagnosis were the main barriers to the early employment of surgical treatment. The recent addition of various methods, as cholecystography, Van den Bergh reaction, icterus index, blood cholesterol, and duodenal intubation, have increased our knowledge in diagnosis and consequently the newer concepts of the disease have increased the indications for operation.

Deaver tells us that once a gall bladder is infected it is always infected. It may become the focus of infection for systemic and cardiovascular disease. He prefers cholecystectomy to cholecystostomy whenever it is possible. Moynihan advocates cholecystectomy in all cases that present "gall-bladder dyspepsia" (a syndrome of flatulence, epigastric discomfort, fullness after meals, and radiating pains between the shoulder blades), when the cholecystographic shadow is absent, its opacity is diminished, or its appearance is delayed. Lahey gives the following as indications for cholecystectomy: (1) In the presence of symptoms such as nausea, gaseous eructations, abdominal distension, headache, and indefinite abdominal pain; (2) failure of investigation and medical measures to demonstrate other lesions which might cause these symptoms; (3) persistence of these symptoms in spite of medical treatment; (4) suspicious X-ray evidence. Blond believes that cholecystectomy is indicated only when all other methods fail and the resorption power of the gall bladder has been destroyed.

CLINICAL ANALYSIS OF 100 OPERATIONS UPON THE GALL BLADDER AND BILIARY TRACT

The analysis of the first 49 cases was based on the usual methods employed, as complete history, physical signs, X-ray examination, laboratory data, operative findings, and post-operative convalescence. In the study of the other 51 cases special consideration was given to the question of drainage after cholecystectomy, cholecystography as a method of diagnosis, and to the preoperative preparation of handicapped patients suffering from obstructive jaundice. The age limits in the entire group was between 19 and 62.

The 49 cases that were operated upon at the Boston Naval Hospital were males, 9 enlisted men and 40 World War veterans. One case was operated upon aboard the U. S. S. *Mercy* and one at the Chelsea Memorial Hospital (wife of a naval officer). Of the 49 remaining cases, operated upon in the Evangelical and the Military Hospitals of Santo Domingo, 17 were males and 32 females. The latter institution is for the treatment of Dominican soldiers, prisoners, and poor.

TABLE I.

Chronic cholecystitis with cholelithiasis.....	67
Chronic cholecystitis without stones.....	25
Acute exacerbation in chronic cases (stones present).....	5
Empyema of the gall bladder (stones present).....	2
Hydrops of the gall bladder (stones present).....	1
Total.....	100

In Table I are listed 100 consecutive cases which were submitted to operation. Sixty-seven of this group showed chronic cholecystitis with multiple stones. Five of these cases were of the "strawberry" type (fig. 1), with a stone impacted at the neck of the bladder. Five additional cases of chronic cholecystitis with cholelithiasis showed acute exacerbations. Surgical procedure was not undertaken until the acute symptoms subsided, but without unnecessary waste of time. It is believed that this method will convert many poor surgical risks into comparatively safe ones. In this respect, an acutely inflamed gall bladder or acute exacerbation of chronic cholecystitis differs from acute appendicitis in that the latter requires immediate operation. Needless to say, a perforated or a gangrenous gall bladder requires immediate surgical interference.

Two cases of empyema of the gall bladder were operated upon. In the first case the obstruction at the cystic duct was not complete, the gall bladder was small, and its walls considerably thickened and its cavity was full of pus. In the second case the cystic duct was completely obstructed. The gall bladder was distended and reached the right lower abdominal quadrant, its wall was compara-



FIGURE 1.—A STRAWBERRY OR CHOLESTEROL GALL BLADDER. THE WHITE SPECKS ON THE MUCOSA ARE DEPOSITS OF CHOLESTEROL. A SOLITARY CHOLESTEROL STONE WAS FOUND IN THE CYSTIC DUCT. (SHAAR)

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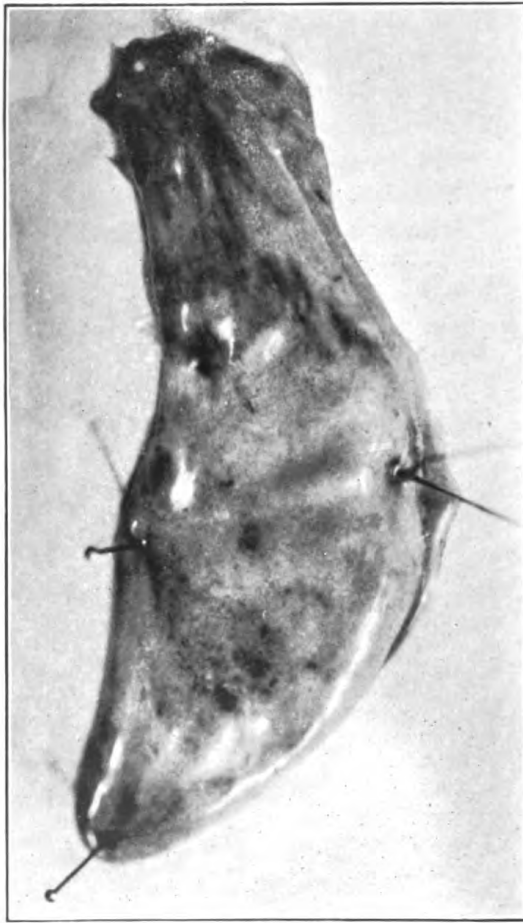


FIGURE 2.—A STONELESS GALL BLADDER SHOWING MARKED AND LONG STANDING CHOLECYSTITIS. NOTE PALLOR AND LOSS OF RUGAE, THE RESULT OF LONG STANDING INFLAMMATION. (SHAAR)



FIGURE 3.—THICKENED GALL BLADDER FILLED WITH CALCULI. (SHAAR)

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tively thin, and 980 c. c. of pus were aspirated from its cavity. Thirty-five faceted stones were removed. Cholecystostomy was the operation of choice because of the patient's condition.

In the one case of hydrops the gall bladder was greatly dilated, its wall were thin, a small stone was impacted in the cystic duct, and 500 c. c. of a clear watery fluid were aspirated.

In 25 cases the chronic cholecystitis was not associated with stone formation. The conspicuous pathological changes in this group were the marked thickening of the gall bladder wall and the contraction of the cavity. (Fig. 2.) Adhesions binding the gall bladder to surrounding structures were present in all 25 of these cases. The presence of various degrees of hepatitis, especially opposite the gall bladder fossa, was noted in 15 cases.

TABLE II.—*Associated pathology*

Appendicitis chronic.....	55
Appendicitis chronic with acute exacerbation.....	1
Chronic pancreatitis.....	3
Duodenal ulcer.....	4
Gastric ulcer.....	2
Malignant disease (pancreas).....	1
Obstruction of the common bile duct with jaundice.....	5

The associated pathology was of special interest. In 55 cases the appendix showed definite pathological changes; in one case acute exacerbation was evident; in 19 cases the appendix appeared normal; in 18 cases appendectomy had been performed at a previous date without relieving the patients from symptoms; and in 7 cases it was not deemed advisable to remove the appendix, or even explore it, because of the patient's condition. In three cases of chronic cholecystitis there was a definite chronic pancreatitis, in four cases of chronic cholecystitis, with cholelithiasis, a healed peptic ulcer of the duodenum was seen. Two other cases showed gastric ulcer. In one case the peptic ulcer was on the lesser curvature and in the other it appeared on the anterior wall. In one case of chronic cholecystitis, with a large distended stoneless gall bladder, the underlying cause appeared to be a carcinoma in the head of the pancreas, with obstruction in the common bile duct. The other four cases of obstruction of the common bile duct, with jaundice, were associated with chronic cholecystitis and stones.

TABLE III.—*Analysis of subjective symptoms*

History of biliary colic without jaundice.....	30
History of biliary colic with jaundice.....	6
History of jaundice without colic.....	1
History of typhoid fever.....	7

History suggestive of peptic ulcer.....	5
Pain in the right upper quadrant.....	75
Pain in the epigastrium.....	15
Pain radiating to the inferior angle of the right scapula and back.....	30
Left-sided pain.....	1
Pain absent.....	9
Appetite conserved.....	50
Appetite fair.....	33
Appetite poor.....	17
Constipation.....	65
Looseness of the bowels.....	5
Atypical symptoms.....	15
Flatulence, fullness after meals, and epigastric discomfort.....	100
Disturbed sleep or insomnia.....	25
Cardiac consciousness.....	15

TABLE IV.—*Analysis of objective symptoms*

1. Tenderness over the gall bladder more pronounced on upward pressure.....	85
2. Diffuse tenderness in the right upper abdominal quadrant.....	8
3. Rigidity of the right rectus.....	7
4. Palpable mass.....	3
5. Cutaneous hyperesthesia in the gall-bladder area.....	7
6. Jaundice (at time of operation).....	4

Cholecystograms were made in 51 cases. The intravenous method was used. There were 2 errors and 49 correct diagnoses.

TABLE V

Absence of gall-bladder shadow.....	10
Shadow of stones.....	15
Very faint shadow of the gall bladder.....	9
Delay in filling and emptying.....	17
Total.....	51

TABLE VI.—*Operations*

Group.....		
I. Cholecystectomy and appendectomy.....	75	
Cholelithiasis.....	50	
Chronic cholecystitis.....	24	
Hydrops (stones present).....	1	
	75	
Chronic appendicitis.....	55	
Acute exacerbations.....	1	
Appendix appeared normal.....	19	
	75	
II. Simple cholecystectomy.....		11
(Appendix removed at a previous date.)		
Cholelithiasis.....	11	
III. Cholecystectomy plus choledochostomy.....		4
(Appendix removed at a previous date.)		
Obstruction of the common bile duct with a stone		
(jaundice).....	4	
Chronic pancreatitis.....	3	

IV. Cholecystectomy plus excision of gastric ulcer.....	2
(Appendix removed at a previous date.)	
Cholelithiasis.....	2
Gastric ulcer.....	2
V. Cholecystostomy.....	7
Empyema of the gall bladder with stones.....	2
Acute exacerbation in chronic cases with stones.....	5
(Appendix was not explored because of patient's condition which did not permit cholecystectomy.)	
VI. Cholecystgastrostomy.....	1
(Appendix removed at a previous date.)	
Total	100

In the five cases associated with obstructive jaundice the patients received intravenously 5 c. c. of 10 per cent calcium chloride solution for a period of three days before operation. The intake of carbohydrates and fluids by mouth was increased to large quantities and glucose solution was given by proctoclysis. These were given to decrease the danger of post-operative hemorrhage. Every one of these patients made a satisfactory convalescence. Four completely recovered. The patient with the carcinoma in the head of the pancreas died eight months after the operation.

The abdomen was closed without drainage in 25 cholecystectomies. These were, for the most part, the best surgical risks. Twenty-three of the group made an uneventful convalescence and, on the whole, their post-operative discomforts and stay in bed was less than of the other patients. The remaining two cases had very stormy convalescence. The first case was operated upon by another surgeon 10 days before and the other was one of my own. Both were submitted to a second operation. They suffered from acute abdominal distension, intraperitoneal bile accumulation, jaundice, nausea, and vomiting. Reoperation did not show any evidence of injury to the bile ducts or other operative error. Bile leakage in both cases was apparently caused by aberrant bile ducts in the gall-bladder fossa. Both cases made an uneventful recovery after the second operation. These cases are reported below:

W. F. R., age 30, World War veteran. The patient was operated upon November 23, 1926. Cholecystectomy was done and the abdomen closed without drainage. After operation he continued having abdominal pain and vomiting, became much worse a week later, and jaundice was marked. There was considerable abdominal distension and the wound was partially opened. December 3, 1926, patient was submitted to another operation. The wound was reopened and a large accumulation of bile in the peritoneal cavity was evacuated. The peritoneal surfaces were slightly reddened and both small and large intestines were distended. There was no evidence of injury to the common or hepatic ducts and bile leakage was from the gall bladder fossa. The fluid was aspirated and

the wound closed with drainage. Following the operation, symptoms subsided and convalescence was uneventful.

F. F. F., age 40, World War veteran. The patient was operated upon October 19, 1927, cholecystectomy and appendectomy were done, and the abdomen closed without drainage. The operative findings: Gall bladder buried in adhesions, considerable thickening of its walls, and its cavity contracted. Liver showed diffuse hepatitis in right lobe, which was more marked opposite the gall-bladder fossa. Healed peptic ulcer in the anterior surface of the duodenum, one-fourth of an inch below the pyloric vein. Appendix was kinked on itself and showed evidence of chronic inflammation. Stomach and pancreas appeared normal. After operation the patient continued having abdominal pain and vomiting. Symptoms became much worse, one week later abdominal distention, nausea, vomiting, and jaundice were well marked on the 9th, post-operative day. On October 29, 1927, the abdomen was reopened. Accumulation of bile in the peritoneal cavity was evacuated. There was no evidence of injury to the bile ducts or other structures; bile leakage was from an aberrant bile duct in the gall bladder fossa. Bile was aspirated and the wound closed with drainage. Improvement was immediate and convalescence was without incident.

In the entire series of 100 consecutive operations upon the gall bladder and biliary tract there was one death. In this case the abdomen was closed without drainage after a simple cholecystectomy:

J. C., age 35, World War veteran. The patient gave a history of gall-bladder attacks extending over a period of one year. Jaundice accompanied one severe attack. On December 5, 1927, simple cholecystectomy was performed without drainage. Operative findings: Considerable thickening of gall bladder, which was matted down with adhesions to stomach, duodenum, and transverse colon. Its cavity was contracted and contained multiple stones. There was extensive hepatitis opposite gall-bladder fossa. Stomach, duodenum, and pancreas appeared normal. Biliary ducts did not show any evidence of stones. Patient developed broncho-pneumonia and died on the fifth day following operation, pulmonary edema being the terminal event. In this case closure of the wound without drainage did not have any bearing on the ultimate result. There was no bile leakage, and abdominal distension, nausea, and vomiting were absent.

SUMMARY

1. This report is based on a study of 100 consecutive operations upon the gall bladder and biliary tract.
2. In the entire series there was one fatality from broncho-pneumonia following cholecystectomy and one patient died from cancer of the pancreas eight months after a cholecystgastrostomy.
3. The most satisfactory results were obtained in cases of cholelithiasis, especially those showing obstruction of the flow of bile.
4. The abdomen was closed without drainage in 25 cases. Two patients were submitted to a second operation because of intraperitoneal bile accumulation. Both cases recovered completely after the second operation and the establishment of drainage. Bile leakage

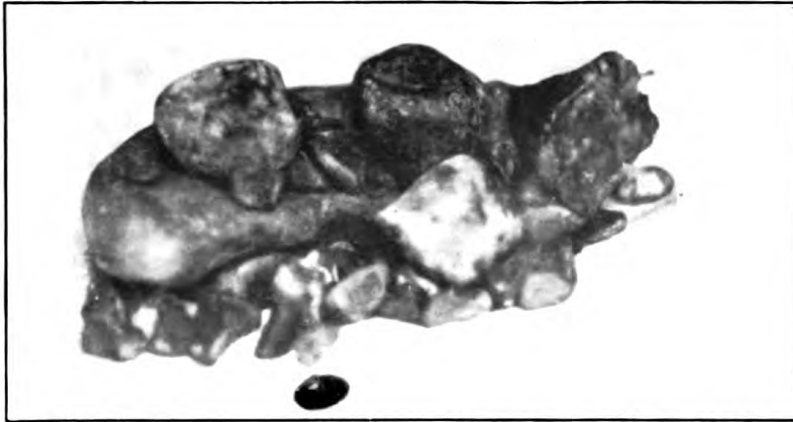


FIGURE 4.—GALL BLADDER SHOWING ADVANCED STAGE OF CHRONIC CHOLECYSTITIS WITH MULTIPLE FACETED STONES. (SHAAR)

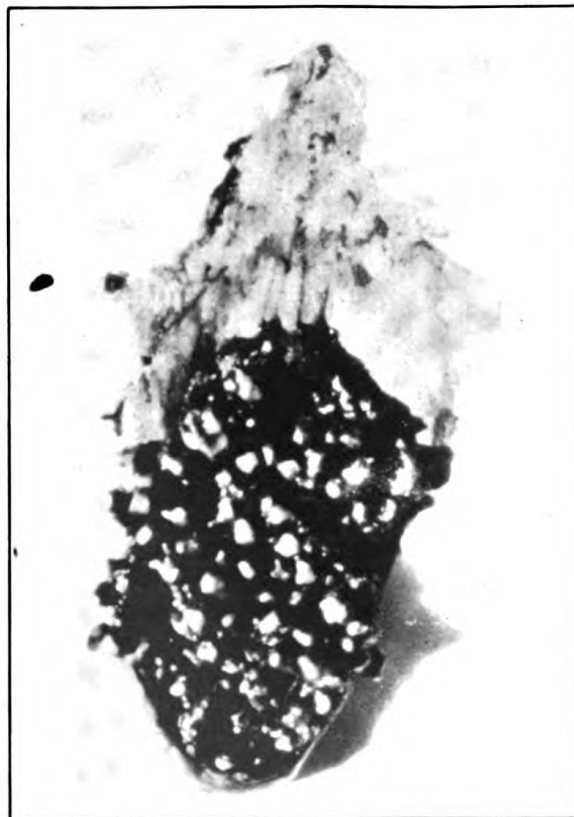


FIGURE 5.—MULTIPLE STONES IN GALL BLADDER OF PATIENT AGED 25. (SHAAR)

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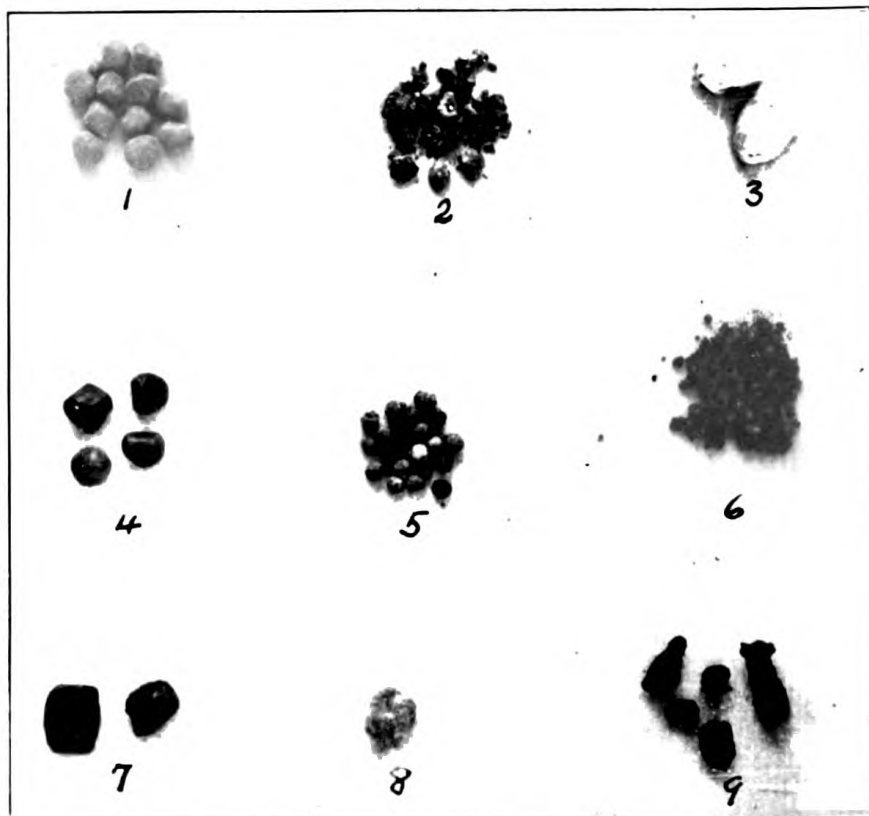


FIGURE 6.—VARIOUS TYPES OF GALL STONES (ABOUT ONE-THIRD ACTUAL SIZE). MIXED CALCULI—NOS. 1, 3, 4, AND 5. CALCIUM BILIRUBIN CALCULI OR BILIARY GRAVEL—NOS. 2 AND 6. PURE CHOLESTEROL CALCULI—NOS. 7, 8, AND 9. (SHAAR)

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was from aberrant bile ducts in the gall-bladder fossa and not the result of any technical operative error.

5. Closure of the abdomen without drainage after cholecystectomy is not a safe procedure. A number of cases have been described in literature, and the two cases cited above are similar instances of bile accumulation.

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THE ISOLATION TYPE OF PERSONALITY

By KARL A. MENNINGER, M. D., Topeka, Kans.

The "rube" of the stage is funny only to those who know nothing about him. They think that he does exist, just so, or else they think he doesn't exist at all. So they can laugh. Those of us who know the original can't laugh; to us the prototype of the caricature is a pitiful, deplorable spectacle—an enormous failure in social adaptation. He has been withheld from sufficient social contacts to humanize him. Of course, all farmers are not "rubes."

Among the personality types prone to failure in social adjustments, the seclusive, withdrawn, queer, eccentric, grotesque, odd, unsociable types are both conspicuous and numerous. Psychological analysis discovers that these are really of two sorts. Some are "constitutionally" unsocial and really prefer to be left out of it, although they may possess graceful social technique; the other group is made up of wistful derelicts who long to dive into the swim and either don't know how or are held back by restraining fears.

The former are called "schizoids." More of them anon. The latter ought to be christened something; "isolated personalities" will do as well as anything. They are those who have been artificially withheld from human contact to the point of developing curious deficiencies, mannerisms, attitudes, oddnesses, which serve to preclude their absorption or amalgamation into the group when, later, opportunities do develop.

The "rube" sometimes comes to college, as some of us know. Sometimes he leaves college only a little less rubish than he entered. It is a task, indeed, to alter a mould that has been setting for 18 years. But it can be done, and it is one of the unwitting functions performed by some of our large State universities and by our Army and Navy.

The farms of the West and the great cities of the East develop two different types of provincialism, or "isolation," equally extreme. It is in the towns and small cities in which socialization reaches its height. But geography and transportation facilities are by no means the sole determinants of breaking the shell. Isolation may result from many other things. We shall illustrate, for example,

1. Isolation by reason of geographic factors.
2. Isolation by reason of being an only child.
3. Isolation by reason of esoteric home training.
4. Isolation by reason of poverty and (again) wealth.
5. Isolation by reason of pathological parents.
6. Isolation by reason of physical defect.

ISOLATION BY REASON OF GEOGRAPHY

"Two sisters from a family none too comfortably situated left a small mountain State to attend a very fashionable university, noted for its social functions. Their attendance was made possible by the fact that an uncle who was very fond of their mother resided in the university town.

"The high-school career of these sisters had been in no way out of the ordinary. They had manifested the usual amount of indifference to their studies and to their teachers and had attended all the simple but enjoyable parties that were given by the students.

"In the university, however, they found themselves left out of social functions that play so important a part in the student life, and after two years of unhappy struggle they returned home. The plain, simple Swedish girls who had left two summers before returned intellectual snobs. Education and learning, so they thought, were the most important things in existence. The simple frankness of the two high-school graduates of two years before had been supplanted by a snobbishness, a sourness, and a bitterness that ill disguised their frustration." (Laird, Donald A.: *Case Studies in the Mental Problems of Later Adolescence, with Special Reference to the Mental Hygiene of the College Student*. *Mental Hygiene*, VII, 4, Oct., 1923.)

ISOLATION BY REASON OF BEING AN ONLY CHILD

At the age of 2, Irene was the center of the concentrated interest and acclaim of two parents, four grandparents, two great grandparents, and 16 uncles and aunts.

At the age of 4, Irene was the single engrossing object of her mother's time, interest, attention, and love.

At the age of 6, Irene was a lonely child, peering wistfully out of the window at neighborhood children, envying them their brothers and sisters. Her mother's exhortations pushed her into the play occasionally, but she was shy and diffident; a few minutes found her standing on the side lines unnoticed and unmissed, and after a session of silent and envious observation she would slip away to play by herself in her playroom of dolls and fancies. She gave trees and pieces of furniture the names of fancied children playmates and talked to them, scolded them, entreated them.

At 10 she was more socialized, thanks to the public school, but she was a grade ahead of her age and far more worldly wise and versed in the ways of adults than her schoolmates. A suggestion of disdain covered up (?) the traces of her loneliness. She found a chum whom she could dominate, and until they grew tired of each other she made the most of the opportunity.

At 16 she was through high school, but considered too young for college and kept at home a year by her parents. "We just can't bear to give her up to go away from home to school; you know she's our only child and she's such a companion to us. Why, I really just take her with me like I would another woman of my own age and talk to her just the same . . . she's so mature, and yet she's still my baby girl!"

In college she was a cold, disdainful, self-centered, little snob. She was elected to a sorority of social pretensions and made a very representative member in that she held her head high, purred softly upon occasion, and kept up the proper front. She utterly disregarded all of the rules and regulations of the chapter, however, and managed to do so with impunity by a haughty unquestioning assumption of prerogative which her sisters feared to challenge. She considered her own comfort and profit first and last.

She graduated with few acquaintances and fewer friends and a reputation for belonging to the upper crust. She married a man who threw himself at her violently and swore to be her slave as long as he lived.

She is busy keeping him to this vow. They have no children. She is too busy.

ISOLATION BY REASON OF HOME TRAINING

"A cadet at West Point complained of depression and a feeling of insecurity. He had been brought up in a home in which he had no companionship except that of his father and his father's friends. The other boys in the neighborhood were not considered suitable company for him; he knew no boys of his own age and did not play boys' games. One can imagine the adjustment difficulties with which he was confronted upon being thrust suddenly into an environment of twelve hundred youngsters of his own age. His colleagues considered him peculiar from the beginning, and this, of course, added to his difficulties. After a feeble effort to adjust, he gave the situation up as hopeless and sought the quietude of his room and his books. Without any attempt to go more deeply into the problem, he was told that his reaction was decidedly unwholesome and was urged to make more contacts. His progress was slow at first, but it was consistent. I had an opportunity to observe this cadet for three years, and I know of no case in which a more gratifying result was obtained. He did not become a class leader, but he was just around the corner from it when he graduated. There was one interesting side light on the situation. One day during his last year he came in quite enthusiastic about a man whom he had met in a near-by city who just couldn't do enough for him. 'Why, he knows lots of my boy friends and he takes us on joy rides, dinner

parties, theater parties, and so forth, and he insists upon paying all the bills, even the hotel bills.' •Upon careful questioning it was learned that girls never attended any of these parties; in fact, the friend did not care for girls. A few weeks later he informed me he had learned that the man was not only homosexual, but was in love with him, and had attempted to kill him. Relations were broken off at once. This cadet is now engaged to be married." (Kerns, Major Harry N.: Management of Acute Mental Hygiene Problems Found Among College Men. *Mental Hygiene*, IX, pp. 276-7, April, 1925.)

Alice is an only child, and the sole object of the adoration of her parents and grandparents. Her mother was also an only child.

From the very first, Alice has been trained to be "a little lady," that is, in everything but her temper, which was uncontrollable even before she could talk. As a baby, whenever Alice was refused anything she wanted she screamed and cried and then held her breath until her mother was frightened into giving her anything she wanted.

When she grew older the process of "breaking Alice's temper" began. It seemed to imply constant surveillance on the part of her mother and grandmother. The latter, who prided herself upon being a Southern gentlewoman, considered Alice too dainty a child to be allowed to soil her clothes and conversation by contacts with the common little neighborhood children. Alice mustn't play boisterous games with yelling and running in them. She played with dolls, but her dolls were little aristocrats, too, who didn't associate with other common dolls. Alice played alone usually, but most of her time was spent with her mother and grandmother.

When she started in school she was always detained by her mother until the other neighborhood children had gone on to school. When they had gone, she was told to hurry on to school and not to loiter on the way home, for she must practice right after school.

Alice's family was continually reminding her of her high scholastic achievements, so that she soon assumed a superior attitude toward the few other children she was allowed to associate with.

As soon as Alice began showing curiosity in regard to sex, her mother "told her everything." After this was accomplished Alice's mother was frantic every time Alice was out of sight.

Now that Alice is in junior high school, she is lonely and odd. She is not an unattractive girl, though instead of being dainty she is big and rawboned. This, added to her awkwardness in meeting people of her own age, makes her predestined to social failure, which is for her parents the greatest of human calamities.

ISOLATION BY REASON OF PATHOLOGICAL PARENTS

"A boy about 10 years of age was at a summer camp and the question came up whether or not he should come back home. He had been there eight weeks and was unhappy. He spent a good deal of the time by himself and was looked upon by the other boys as queer, peculiar, eccentric. He had not participated in swimming, riding, and playing games; and, on the whole, he had been an undesirable comrade. When he first came, some of the other boys teased him, but soon he was passed by and ignored. The question was, Why should a boy 10 years of age be queer, peculiar, and eccentric, standing out alone among 60 other boys?

"In order to understand each type of individual, we must interpret conduct in terms of past experiences. Now, going into the past experiences of this boy, we find that the father is a professor who has a position of prominence. Five years ago the boy's mother died of an acute infection. The father was so emotionally upset that he developed an exaggerated and distorted condition of health. He got a nurse for the boy, and she was told that this child must be protected against every possibility of sickness. The boy was not allowed to go to the public school or the private school, but had tutors at home. He was not allowed to ride on public conveyances, and only occasionally permitted to play with other boys. So his whole life was built around the problem of ill health.

The emotional reaction in this father was, of course, in response to a serious situation, but most individuals are able to recover and adjust themselves, even in the case of the loss of a person very near to them and much beloved, and to make the experience a part of their lives. It is a part of our plasticity in life to be able to do this, but here was a man, a professor, an intellectual man, who stands out as a leader in his particular field, whose emotional reaction was so intense that he could not do so, and he planned the life of this boy around his emotional reaction, with the result described." (Thom, Douglas A.: *Moulding Personality in the Pre-School Years*. *Mental Hygiene of Normal Childhood*, p. 40, January and February, 1927.)

ISOLATION BY REASON OF POVERTY

Both wealth and poverty may bring about isolation, as every movie fan knows. (The "Poor Little Rich Girl" theme of Mary Pickford's proclivity and the all, all-alone horrors of Lillian Gish in "Squalor.") College students and their advisors know it at first hand.

All through the grades Lucile had two anxieties—the anxiety of keeping up in her studies and the anxiety of poverty. These were

the two topics which she heard discussed in her home. Her parents were poor and hard pressed, and her mother was a woman of high idealism who expected Lucile to make up in intellectual brilliancy what she lacked in glad raiment and finery.

Unfortunately Lucile was a normal child and hence couldn't make this extraordinary compensation. The constant reminders of her poverty which she received from her mother's tears, her father's complaints, and the obvious comparison of her clothing with that of her schoolmates combined to produce in her a marked sense of inferiority. In order to avoid the unpleasantness of comparisons, she quietly withdrew from situations in which such opportunities were afforded. In high school, when the students' social life began to develop, she voluntarily excluded herself by declining invitations and avoiding opportunities. Because of her pretty face and sweet manner, she was in a way to be very popular, but she would decline dates and resort to various subterfuges and circumlocutions to avoid the humiliation of having her friends see the shabbiness of her home.

During her senior year in high school a relative died, leaving her mother considerable money. It was decided that she should go to college. She outfitted herself prettily and her mother bought her a Ford for her own private use, so that she entered college with considerably more than the average personal comfort. The old habits, however, were hard to break. She was shy, diffident, retiring, and self-distrustful. These traits, together with her evidences of prosperity, stimulated the enviousness and dislike of her companions who had formerly loved her for her very meekness. Her life was lonelier than before. She left college in her sophomore year.

An example will show us the effect of the opposite type of home atmosphere on a girl who was fundamentally normal. In this case, as so often, the person developed an inability to make friends and lacked self-confidence. She is always inconspicuous in a group, in spite of attractive dress, pleasant face, and kindly disposition. The girl is longing for friends and companionship, but as no one goes out of his or her way to talk to her she simply goes more into the background. At times she has developed a really dangerous dependency as a result.

The fact is that the parents laid emphasis on the material side of life and built their home atmosphere on it. None of the three children were anxious to remain at home, though they loved their parents and the parents provided liberally for them. There was no friction between father and mother.

What was the matter? The atmosphere was simply the atmosphere of a fine store or hotel. The furnishings were tasteful, rich, and beautiful. The children grew up in it and were taught to think

that if they looked and behaved well they would grow up to marry and live happily ever after. From the start the girl was known at school as the most spick-and-span child in the class. Her dresses were always white and starched. She learned her lessons with the same mechanical precision and could rattle them off faster than anyone else.

To her parents dirty clothes meant inferior people not fit to play with. Consequently she, like her older sister, lost her childhood companionship. They could not play with or know the children at school or in a large part of their neighborhood. The parents were unaware of the spiritual malnutrition of their children, and did not even attempt to make up for the lack of playmates by themselves playing with the children. And if quarreling and harsh words were unknown in the household, so were noise and laughter.

The girl fortunately possessed a good physical, emotional, and intellectual makeup, which has helped pull her through a very difficult period. Now, at 28 years of age, still unmarried, she has become aware of the deficiencies of her early life, and with unusual intelligence she has changed her business life to one of work with children, which is helping greatly to satisfy her lonely longings and giving her greater ease with people of her own age. She is practically free from her previous spells of depression. (Hallowell and Pauline Davis, *Harvard Alumni Bulletin*, 1928.)

ISOLATION BY REASON OF REAL OR FANCIED PHYSICAL DEFECT

The isolation of the deafened or crippled child is an obvious tragedy, to avert which systematic efforts are now made in most civilized communities.

Far more frequent, more devastating, and more inaccessible are the isolation and suffering caused by the famous sense of inferiority based (usually) upon fancied defects or upon the emotional reactions to defects which of themselves are not isolating.

THE SENSE OF INFERIORITY

"A sense of inferiority" is a phrase so aptly describing a painful emotional experience common to all mankind that when coined by the psychiatrists it was immediately appreciated and pressed into use by the laity as well as the medical profession.

What is it, and why: The sense of inferiority is a complex, painful, emotional state characterized by feelings of disadvantageous comparison, of incompetence, inadequacy, and depression. With it go certain typical traits or tendencies, particularly—

1. Self-consciousness or self-preoccupation; shown by blushing, embarrassment, delusions of reference, a tendency to be concerned with one's feelings, thoughts, plans, motives.

2. Self-criticism and self-dissatisfaction; a tendency to feel that one is not appearing to good advantage, to be critical and worried about what one is doing or has done, to reflect on possible mistakes and blunders.

3. Touchiness and oversensitiveness; a tendency to make exaggerated responses to praise, blame, defeat, and disappointment, to care intensely about what other people think of one.

4. General emotional and nervous instability; unresolved emotional complexities and antagonistic trends, fits of despondency, depression, apathy.

5. Persecutory trends of a more or less definite sort; the feeling that one is unappreciated, unjustly treated, that the world in general fails to appreciate and reward merit, and to recognize wrongdoing.

6. Unwillingness to put one's self to the test because of fear of an unfavorable outcome, which would be intolerable.

7. Lack of ability in certain lines of overt behavior which demand a fair degree of self-assurance; lack of social poise; inability to carry on enterprises such as selling and executive work.

8. Perfectionist tendencies; an attempt to compensate for felt inferiorities by exaggerated conscientiousness, meticulousness, fastidiousness.

(Heidbreder, E. F.: The Normal Inferiority Complex. The Journal of Abnormal and Social Psychology, Vol. XXII, No. 3, October-December, 1927, p. 248.)

What causes it? Real disadvantages of physique or talents or race or appearance; these, to be sure. But many persons quite overcome these handicaps—they may or may not achieve greatness, but they do achieve happiness.

The sense of inferiority depends not upon actual comparisons, but upon certain emotional predilections, and prejudices based upon fear. These date back to earliest childhood and are added to or subtracted from thereafter according to the mental healthiness of the parents and home environment.

Basically, feelings of inferiority depend upon comparisons of the subject with other individuals, and these comparisons are originally of tangible, visible things, i. e., physique and physical accomplishments.

The child early compares himself, his little body, his physical equipment, with that of his omnipresent and omnipotent parents; later, also, with siblings and playmates. Necessarily he is constantly aware of discrepancies in size, in height and weight, in

strength. His obvious inferiorities are associated with his obvious dependency and subservience. Since what father and mother say "goes," he is early taught without words that "might makes right." This may as well be written "height makes right."

The child's first reactions to the constant reminder of his littleness take many forms. There comes to be a resentment of being called "little." There is much talk of "when I grow up"; mamma and papa games are indulged in; long dresses and trousers are donned, and various types of rebellion and insubordination are indulged in, in spite of foregone conclusions of ultimate defeat.

These compensations, which the child makes gradually, become less necessary as the child becomes aware of his growth. Soon I will be as big as they, he thinks—and so he is often told.

There are certain other comparisons which the small child makes which leave most stubborn resistance. These relate to comparisons which, from the covert or coy behavior of his parents, he infers should not be made. They relate to the tabooed areas of the body. The axillary and pubic hair, for example, are never-failing sources of mystery and humiliation. It is so definitely there on his parents and so definitely not there upon his own little person. What is wrong that he is thus minus this attribute of the big and powerful folks?¹

Not only the hair but the primary and secondary sexual organs are noticed by every child. The little boy compares his small genitalia with those of his father and suffers more acutely in his perplexity than most of us stop to consider. He wonders what is wrong that he is so incomparably less developed in this not-to-be-discussed part of his body. Later he becomes conscious of pleasurable genital sensations and a sense of guilt develops with the theory that his underdevelopment is a punishment. Similarly, the little girl is not only chagrined to discover the equipment of the males of her family, but she is distressed at her lack of breasts such as her mother has. Psychoanalysis of many patients has revealed that the child spins theses to account for these lacks and develops innumerable compensatory defense mechanisms to save himself the pain of an inferiority realization.

Now such inferiority feelings are common to nearly all children. They are based, to be sure, on misconceptions and ignorance, but the emotional response is there, and it has to be expressed. It may be handled very easily—a harmless discharge as it were, especially where proper educational methods and manners are used by the parents.

¹ Readers will be reminded that hair as the symbol of power runs through all history and legend—Samson, for a classical example; Dempsey, for a more modern one; "The Hairy Ape," for an O'Neill elaboration of the theme.

These primary inferiority feelings are ordinarily submerged into oblivion in the majority of persons. But nothing in human life is ever really forgotten. The memories only sleep. Hence it is easy to revive these childish anxieties and add to their intensity a few years later by unfavorable comparisons made by some one in authority, such as: "Sam is not as bright as his sister," says mother to a visitor. "George is unusually awkward and clumsy for his age." "Daughter, it's a good thing you are smart in your studies, because you certainly are the homeliest child on earth." "John's teeth are so ugly, they make him look just terrible." "There's no use in paying out any more for your music lessons—you haven't the voice." (This girl later became a professional musician and concert singer.)¹

Such comments are deadly. They often crush the child's hopes and efforts and self-respect completely. They rarely stimulate, because the authority of their source makes them incontrovertible.

Then there are other less obvious ways in which parents stimulate and build up inferiority feelings in their children. One is by manifesting their own inferiority feelings. Some parents are incessantly complaining of their misfortunes, comparing their acquisitions and opportunities with those of their neighbors, voicing their enviousness and unhappiness and disappointments. They may go further and berate themselves, or they may scowl and sneer at their envied friends. In either case, the effect on the child is the same—"My folks lost out; they're licked. They aren't as good as"

The social organization of most American cities is built up upon the existence of this sensitiveness. Many exclusive clubs keep their dues unjustifiably high and their membership dismally lonely in order that the members may gain consolation for their inferiority feelings by the realization that many envy them in their exclusiveness who can't afford to join.

Still other parents excite inferiority in their children by their delinquencies. The child feels much more keenly than his parents the social disapprobation which they incur. An alcoholic father or a divorced mother may serve as a burden of bitterness to the children throughout their lives. This we see frequently appearing in college students, whose sense of inferiority crops out conspicuously under the stress of readjusting themselves to the new requirements of college life. "I have always felt as if I must apologize for my father," one remarked in discussing his self-consciousness. "I always have in the back of my mind 'What if they knew!'"

Many children early develop certain types of reaction to these inferiority feelings—patterns which continue to dominate their behavior long after the original cause is extinct. Others develop

¹ These are all true quotations.

them later. Enviousness, aggressiveness, penuriousness, acquisitiveness, flight reactions, anxiety states, bluffing, stealing, and all sorts of adventitious behavior may result—does result. The roots of many neuroses of later life are to be found here. "Neurasthenia," in which a patient is sure that his or her eyes are weak, stomach ailing, legs impaired, etc., are states in which unconsciously these organs are used as substitutes for others concerning which, as a child, the sufferer had grave and painful misgivings.¹

Alfred Adler's theory is that the child who actually does have a lack, an organic inferiority, may become aware of it without becoming conscious of it—i. e., he may react to it without knowing to what he is reacting. The weak-eyed become artists, the poorly endowed gastrointestinal tracts drive their owners to become cooks, the possessors of poor ears turn to music as a career. Beethoven, Demosthenes, Whistler, and many others are cited to prove this.

But there are certain conditions of which no one needs to speak, and yet the organic inferiority can not remain unknown to the subject. He knows because he can see himself in the eyes of strangers; he knows because the cruel taunts of the little animals about him, glad to find some one their inferior and some one to torture, won't let him forget.

This group includes speech defects, birthmarks on the face, dental deformities, crippled limbs, deformed bodies, and above all, cleft palate and harelip. So obvious are these things and so disfiguring that they permit of little real protection from exceedingly great mental pain.

A patient of ours, a woman of 52, lived as a recluse on a large ranch in Kansas, one-half of which she owned, but which she rarely ever left. She had a curious speech defect which immediately attracted attention wherever she went, whenever she spoke. She felt her immolation keenly; she went through phases of bitter resentment, cynicism, sad resignation, hopeless despondency. All her life it was her chief concern. "I've never been able to forget it long

¹ The following example cited by Doctor Kerns, mental hygiene counsellor at West Point, is typical: "Cadet G. came to the hospital complaining that he felt weak and insecure. He was afraid of everything, afraid that something was going to happen. He could get interest in nothing but his own thoughts. He worried constantly and had even thought he was going insane. This lad was seen for an hour on each of three successive days. He was markedly introverted, self-conscious, and deplorably lacking in aggressiveness. He displayed all the earmarks of an inferiority mechanism, based, it appeared, among other things, upon a diminutive stature. This mechanism, along with certain other contributory ones, was gone into quite carefully and explained to him. He was given Hart's *Psychology of Insanity* to read and told to return in one week. A month later he appeared and said that he was getting along finely and saw no reason why he should not continue to do so. The book, apparently, had mirrored and explained away many of his own problems. I can almost recall his words: "I think a book of that sort should be placed in the public schools, for I know that lots of people have grown up in the dark, so to speak, just as I have." (Acute Mental Hygiene Problems in College Men. *Mental Hygiene*. IX, No. 2, April, 1925.)

enough to get interested in the real things of life," she said. We tried to help her find a happier viewpoint, but one day she was found dead across her bed, and an empty cyanide bottle on the floor.

One of our senior students at Washburn College a few years ago was among the brightest girls we have ever had. She came of a good and respected family and she was not unlovely to look upon. But from infancy she had been obliged to wear very heavy lenses for her near-sightedness. They were, to be sure, rather conspicuous. But they were nothing in comparison to the conspicuousness she had come to think they had. She felt that everyone who looked at her saw the glasses rather than the girl; she was so self-conscious that she became seclusive, and her seclusiveness made her odd, and her oddities made her more uncomfortable and conspicuous. Her life, full of opportunities by reason of her superior intellectual gifts, was near ruined by her emotional distortion.

One of my friends had a child with harelip who was so tortured by his schoolmates, who reviled and jeered him, that his parents moved from place to place seeking to find more tolerable conditions. In this instance, of course, not he alone but his whole family suffered untold agony.

The wounds of the soul resulting from these disfigurements are made very early in life. Entirely aside from surgical considerations, these blemishes should be eliminated just as early as possible in the life of the child, from the standpoint of mental hygiene. Five, six, or seven years of age is much too late. The prevention of mental illness in these instances is early surgical treatment of the physical defect.

For the others, preventive treatment consists in better mental hygiene instruction for the parents. Lacking this (prevention), we must resort to psychotherapy. This is one of the functions of the psychiatrist in practice, but no where with more satisfaction than in the treatment of inferiority reactions developing in college students.

The dentists have done much with orthodontia in the direction of mental hygiene. Many such cases as the following are reported in the dental literature. "A stenographer, aged 24, had been under treatment for two years for a very bad disfigurement of the face caused by dental deformities. The mental effects were particularly marked. She had always taken a position in the back office where it would not be necessary for her to meet the public. Two years later she was working in the front office and wearing an engagement ring." (Robertson, T. M.: *Int. Journ. of Orthodontia, Oral Surgery and Radiography*. XI, 9, September, 1925.)

HYDROGEN ION CONCENTRATION

By Chief Pharmacist C. SCHAFER, United States Navy

INTRODUCTION

The importance of detecting and controlling acidity and alkalinity in practically all branches of research and industrial work has long been recognized, but the real value of accurate measure was not fully understood until the past few years, when the development of accurate though simple methods demonstrated that the old way of testing for reaction by using litmus paper and by titration led to erroneous results. In the past it was believed that the measure of reaction was a constant based entirely on the total quantity of acid or alkali in a liquid, and, accordingly, it was then customary to determine and adjust the degree of acidity or alkalinity from the titratable material present. Now we know that the intensity of reaction depends only on the concentration of hydrogen ions, the strength of which can not be found by titration but may be easily and exactly determined by special colorimetric or electrometric tests.

The value of hydrogen ion concentration in its application to everyday life is brought to us more fully when we realize that the bacteriologist and the pathologist uses it in working out his problems, and when we hear on every side how the industrial chemist in nearly all branches is using pH control in seeking to improve methods of manufacture with a view of reducing the cost of production and of improving the quality of the output.

In most instances efficient operation can only be obtained by adjusting the pH to a point most favorable for some specific reaction to take place. For example: The paper manufacturer resorts to pH control in order to completely precipitate the gelatinous material without using a large excess of alum; thus a former waste of alum that amounted to as high as 200 per cent over that required has been entirely eliminated. Sewage-disposal plants make use of pH control in order to keep the sludge at the proper reaction, for, if too acid or too alkaline, digestion is slow and offensive odors are given off. In the manufacture and refining of sugar the degree of acidity must be kept within narrow limits in order to prevent inversion and discoloration. Textile mills naturally find wide application for pH control in the processing of silk, wool, cotton, and other fabrics the fibers of which are easily damaged when the reaction of the various baths is not kept at a point where best results are obtained. In the purification of city water, in the manufacture of milk products, and in the conditioning of milk for various purposes, in the canning industry, in the tanning of leather, in the manufacture of pottery, in electroplating and electrotyping, in baking, in gardening and farm-

ing, in the manufacture of explosives, dyes, chemicals, and drugs, as well as in other fields too numerous to mention, hydrogen ion-control methods are extensively used to prevent waste and to increase the quality and yield.

In the study of microorganisms it is well known that the reaction of the culture media has a very important bearing on the growth of bacteria as well as on yeasts and molds; therefore the bacteriologist resorts to hydrogen ion-control methods for adjusting the degree of acidity or alkalinity to a point known to give best results. In the study of disease the hydrogen ion concentration of the several body fluids may have considerable diagnostic importance, for certain pathological conditions are manifested by disturbances in the normal pH of the blood, urine, or gastric juice.

The foregoing is no more than the briefest review regarding hydrogen ion concentration in health and disease and its application in the many industries. No attempt is made to describe special methods, the details varying widely to suit the different lines of work. Those who may be interested in the application of pH to special problems are referred to the literature mentioned in the list of references at the end of this article. However, the subject of hydrogen ion concentration will be presented here in a general way, with the idea of making the fundamentals understandable to those who are uninformed.

HYDROGEN ION CONCENTRATION AND THE PH SCALE

There exists among those who are not chemists a good deal of misunderstanding regarding the subject of hydrogen ion concentration, and because of this many hesitate to attempt to make even simple determinations. But pH measurements can be made with considerable accuracy by those not specially trained in physical chemistry and electrophysics, since the operator needs only to read directions and match colors.

Hydrogen ion concentration means gram weight of ionic hydrogen per liter of solution, and, therefore, hydrogen ion determinations are made with a view of expressing the intensity of a reaction, whether it be acid or alkaline, in terms of ionic hydrogen, using definite measures of quantity which can be recorded and duplicated at any time by the same or different workers.

All liquids of which water is a constituent contain positive hydrogen ions and negative hydroxyl ions, the former giving rise to acid reactions and the latter to alkaline reactions. Liquids in which the number of hydrogen ions exactly equal the number of hydroxyl ions are neutral in reaction; those in which the hydrogen ions are greater in number have an acid reaction, and liquids containing more hydroxyl ions than hydrogen ions are alkaline in reaction. The degree

of acidity or alkalinity varies directly with the preponderance of one group of ions over the other. The advantage of making hydrogen ion determinations over the old litmus test for reaction is readily seen by noting that we use terms expressing definite quantity in substitute for the very indefinite terms "strongly," "moderately," and "weakly" acid or alkaline, not to mention the term "neutral," which when based on a litmus test is very apt to be off the exact point of neutrality.

Of the numerous symbols in use for expressing "hydrogen ion concentration," probably the one most commonly used in this country is $[H+]$. As already explained $[H+]$ means the weight of ionic hydrogen per liter of solution, but as the total range of the $[H+]$ scale is covered by quantities from 1.0 to 0.00000000000001 gram, it is obvious that the general use of hydrogen ion concentration in terms of grams per liter would prove inconvenient and clumsy in routine work; and, moreover, such values could not be plotted, for if the difference between 0.00000000000001 and 0.00000000000002 is given a length of 1 millimeter in the chart, the difference between 0.1 and 0.2 $[H+]$ when plotted on the same scale would be 1,000,000 kilometers, or approximately 620,000 miles. To overcome these difficulties, Sorensen suggested the now well-known "pH" scale. The derivation of the symbol "pH" is undoubtedly the words "potential" and "hydrogen." The pH, sometimes referred to as the Sorensen value, is not identical with hydrogen ion concentration, although it expresses $[H+]$ in a more simple form. A better appreciation of how the use of pH values simplify the expression of $[H+]$ can be had by comparing two equivalent values; for example, $[H+]$ 0.00000381 has the Sorensen value of pH 5.42.

The separation of molecules into ions is known as dissociation of molecules; thus the presence of H and OH ions in any liquid is the result of dissociation. Since the terms ionic, or ionized, hydrogen and ionizable hydrogen are likely to prove confusing, it is well to note the difference between the two. For the purpose of illustrating this difference, take any substance which is partly dissociated in solution with the liberation of hydrogen ions; hydrochloric acid, for example, when added to water ionizes to a certain degree, with the result that a portion of the total number of molecules originally in the form of the acid are dissociated into positive hydrogen ions and negative chlorine ions, while the remaining molecules are unchanged and are still in the molecular HCl state. These remaining molecules of HCl may, under certain conditions, also undergo ionization. The hydrogen of the dissociated molecules is, naturally, ionized hydrogen, while the replaceable hydrogen remaining in molecular combination is ionizable hydrogen.

The intensity of any acid is due to the degree of ionization which the acid undergoes in solution; the greater the degree of ionization the more ionic hydrogen and the stronger the acid. The same holds true about the intensity of alkaline bases, excepting that here the product of dissociation of special interest is ionic hydroxyl. The total quantity of any acid, or base, in a liquid includes both that which is in the dissociated and in the molecular state. This quantity can not be determined by hydrogen ion concentration methods, but is found by volumetric or gravimetric methods of analysis; on the other hand, the intensity of a reaction depends altogether on the amount of ionic hydrogen in the liquid, a value that can only be found through hydrogen ion determination methods. Thus the total acid, or alkali, in a solution is a quantity factor, while the amount of hydrogen ion in the liquid is an intensity factor. Two or more liquids may contain like amounts of the same acid and yet have entirely different pH values.

Pure distilled water will conduct an electric current to a very slight extent, indicating that only a very small portion of the water is dissociated into positive H ions and negative OH ions. According to the law of mass action the equilibrium relationship may be expressed by the following formula:

$$\frac{[H+][OH-]}{(HOH)} = k$$

The brackets in the foregoing equation indicate the concentration of the ions represented and this concentration is always expressed in terms of grams per liter. Since the concentration of undissociated water is enormous in relation to the dissociated products, the quantity of undissociated water will not be affected appreciably by the slight dissociation that occurs, and may therefore be taken as a constant, the above equation becoming:

$$[H+][OH-] = kw$$

By electric conductivity measurements kw has been found to be 0.00000000000001, or, to use a negative exponent, 10^{-14} . This factor is the dissociation constant for water at 22° C., and it follows, therefore, that no matter how concentrated the hydroxyl ions may be, there must remain sufficient hydrogen ions to satisfy the relation indicated in the above formula. Thus, by formulating a system of measure based on the ionization factor of water, a scale is laid down in terms of $[H+]$ to cover the whole range of alkalinity as well as acidity.

The equivalent pH value for any given concentration of ionic hydrogen is the logarithm of the reciprocal of that concentration. Thus

$$\text{pH} = \log \frac{1}{[\text{H}^+]}$$

For example, 1000000 is the reciprocal of 0.000001 and the log of this is 6, which is the pH for the $[\text{H}^+]$ 0.000001. The following diagram illustrates the dissociation relationship between $[\text{H}^+]$ and $[\text{OH}^-]$ and shows the equivalent values in the pH scale.

RELATED VALUES IN THE pH SCALE

Hydrogen ion concentration	pH value	Hydroxyl ion concentration
1.0 or 10^{-0}	0.0	10^{-14} or 0.00000000000001
.1 or 10^{-1}	1.0	10^{-13} or .00000000000001
.01 or 10^{-2}	2.0	10^{-12} or .00000000000001
.001 or 10^{-3}	3.0	10^{-11} or .00000000000001
.0001 or 10^{-4}	4.0	10^{-10} or .00000000000001
.00001 or 10^{-5}	5.0	10^{-9} or .00000000000001
.000001 or 10^{-6}	6.0	10^{-8} or .00000000000001
.0000001 or 10^{-7}	7.0	10^{-7} or .0000001
.00000001 or 10^{-8}	8.0	10^{-6} or .000001
.000000001 or 10^{-9}	9.0	10^{-5} or .00001
.0000000001 or 10^{-10}	10.0	10^{-4} or .0001
.00000000001 or 10^{-11}	11.0	10^{-3} or .001
.000000000001 or 10^{-12}	12.0	10^{-2} or .01
.0000000000001 or 10^{-13}	13.0	10^{-1} or .1
.00000000000001 or 10^{-14}	14.0	10^{-0} or 1.0

It will be noted in the above diagram that the values shown in the two columns adjoining the pH scale on the left and right are identical with the values appearing opposite them in the first and last column, respectively, the only difference being that exponents are used in place of ciphers. In view of the general use of negative exponents in expressing the weight of hydrogen ions, one should remember that they indicate the reciprocal of the base (10) raised to the power shown; for example, $10^{-3} = 0.001$; the third power of 10 is 1000, and the reciprocal of this is 0.001. One should not confuse the negative exponents with the pH logarithms. Although the exponents in the $[\text{H}^+]$ shown above happen to be the same as the corresponding pH log, this only occurs where there is no fractional part in the pH value. This will be shown later under examples showing how to convert pH to $[\text{H}^+]$.

With further reference to the above diagram, it will be noted that the ionization constant 10^{-14} (0.00000000000001) may be proven in any case by multiplying the hydrogen ion by the corresponding hydroxyl ion concentrations. Regarding negative exponents, multiplication is accomplished by adding them. Note also that the diagram is shown in steps of 10; that is, any given value for $[\text{H}^+]$ below 1.0 is one-tenth of the value next higher in the scale. While the scale is shown only in whole numbers, in practice the values

met with generally have fractional parts which is easily explained by the fact that the difference between any two consecutive values shown in the above table is not 1, but 10. As we are dealing with logarithms in the pH scale it should be remembered that pH 6 contains 10 times as many H ions as does pH 7, and pH 5 contains 100 times as many as does pH 7.

Since values in the pH scale are expressed by logarithms of the reciprocal of the hydrogen ion concentration, it follows that the numerical order in the pH scale is inverted in reference to the hydrogen ion concentration it represents; thus, with increasing pH values from 0 to 14 there is a corresponding decrease in hydrogen ion concentration and a corresponding increase in hydroxyl ion concentration in order to maintain the equilibrium of 10^{-14} . At pH 7 there is an equal number of hydrogen and hydroxyl ions, the concentration in each group being 10^{-7} , and therefore pH 7 is the neutral point. Decreasing the pH from 7 toward 0 is accompanied by a progressive increase in $[H+]$ over $[OH-]$ with a corresponding increase in acidity; on the other hand, increasing the pH from 7 toward 14 is accompanied by a progressive increase in $[OH-]$ over $[H+]$ ions with a corresponding increase in alkalinity. In other words, pH 0 indicates the highest concentration of hydrogen ions and the highest degree of acidity, and pH 14 indicates the lowest concentration of hydrogen ions and the highest degree of alkalinity.

Determinations are generally made and recorded in terms of pH, and it is seldom necessary for workers to convert pH values into $[H+]$. However, such calculations as well as the reverse are easily made, as shown by the following examples:

To convert pH values into hydrogen ion concentration,

(a) When the pH value has no fractional part;

Multiply 1 by 10^{-n} .

n =the characteristic (whole number) in the pH log.

Example.—pH 8.0= 10^{-8} , or 0.00000001.

(b) When the pH value has a fractional part;

Subtract the mantissa (fractional part) in the pH log from 1.00; find the antilogarithm for the difference, place a decimal point after the first figure, and multiply by 10^{-n+1} .

n =the characteristic in the pH log.

Example.—pH 8.25= $[H-] 5.623 \times 10^{-9}$, or 0.000000005623.

The calculations are as follows:

Subtract 0.25 from 1.00=0.75.

The antilog of 0.75 is 5623; place a decimal point to the right of the first figure=5.623.

The characteristic in the pH log is 8, add 1=9; therefore, 5.623×10^{-9} , or 0.000000005623=pH 8.25.

To convert hydrogen ion concentration to pH:

Find the mantissa of the number and place a decimal point before it. Find the characteristic, which number is the same as the negative exponent, or, the same as the number of places from the decimal point to and including the first significant figure on the right; subtract the mantissa from the characteristic.

Example (a).— $[H+] 1 \times 10^{-8}$, or $0.00000001 = \text{pH } 8.0$, calculated as follows: The mantissa of 1 is 0, the characteristic of the value is 8; $8 \text{ minus } 0 = \text{pH } 8.0$.

Example (b).— $[H+] 5.623 \times 10^{-9}$, or $0.00000005623 = \text{pH } 8.25$, calculated as follows: The mantissa of 5623 is 75; place the mantissa on the right of a decimal point 0.75; the characteristic in the hydrogen ion concentration value is 9; subtract 0.75 from 9.00 = pH 8.25.

BUFFER ACTION

Buffer action means the resistance exhibited by a solution to change in pH through the addition or loss of acid or alkali. In general it may be said that the salt of a weak acid is a buffer salt; for example, phosphates, carbonates, silicates, alums, borates, acetates, as well as salts from a vast number of more uncommon acids, have buffer action. Since buffer salts need only be present in minute quantity to impart buffer action, it follows that because of the presence of one or more of these salts in small amounts nearly all liquids are buffered.

In order to see more clearly how buffers repress changes in pH let us consider an aqueous liquid containing acetic acid and sodium acetate and note what happens to the pH on the further addition of acid: Acetic acid, being a weak acid, is only slightly dissociated in water into CH_3COO and H ions; the water in the liquid is also slightly dissociated into H and OH ions, and the sodium acetate dissociates to a considerable extent into ions of CH_3COO and Na . The but slight dissociation of acetic acid means that CH_3COO and H ions can not exist together in solution to a considerable extent, while the large dissociation of the sodium acetate indicates that ions of CH_3COO and Na can exist together in solution to a considerable degree. Inasmuch as only H and OH ions have direct bearing on the degree of acidity or alkalinity, the H ions of the dissociated acetic acid, together with the H and OH ions of the dissociated water in the liquid under consideration, are the only factors that enter in the pH value. The CH_3COO of both acetic acid and sodium acetate and the Na ions of the latter, having neither acid nor alkaline properties, do not affect the reaction. Let us consider what influence the addition of any acid to this liquid will have on the

pH: Take hydrochloric acid; HCl dissociates in water to a considerable extent into H and Cl ions; therefore it would seem that the addition of HCl would increase the hydrogen ion concentration of the liquid and the acidity as well, but such is not the case because of the buffer action of the sodium acetate.

To understand thoroughly buffer action requires a knowledge of physical chemistry, especially that which deals with the laws of dilute solutions and ionic equilibrium; therefore a nontechnical explanation of that function must of necessity be very superficial. The liquid discussed in the preceding paragraph contains the exact number of H ions that may exist with the amount of CH_3COO and OH ions present; therefore, additional hydrogen ions through added hydrochloric acid combine at once with CH_3COO ions of the dissociated buffer salt to form molecular acetic acid, and the amount of hydrogen ions in solution thus remains unchanged. What also happens, however, is a further dissociation in the reserve portion of the sodium acetate to compensate for the loss of CH_3COO ions taken up by the added hydrochloric acid. Now, let us consider what will happen to the pH on adding NaOH to the solution. This base is partly dissociated into Na and OH ions, and since the liquid contains the exact amount of OH ions that may exist with the quantity of H ions present, the OH ions of the dissociated NaOH combine at once with the H ions to form water, and a portion of the undissociated acetic acid splits up into ions of CH_3COO and H to replace such of these ions as have passed into the molecular combinations of water and sodium acetate on account of the added OH ions of the NaOH. Consequently, the original concentration of hydrogen ion remains undisturbed.

This explains very briefly the action of buffer material, showing why the addition of acids and bases in buffered solutions do not change the pH. Since the relation of H and OH ions in any given solution is a constant, it stands to reason that the addition of water to a buffered liquid does not change its pH; this is accounted for by further dissociation of the material contained in order to furnish the required additional number of H and OH ions to maintain the same hydrogen ion concentration in the increased volume of liquid.

Because the addition of water as well as the addition of acids and alkalis do not effect the pH of a buffered solution, no special precautions are necessary in making pH measurements on solutions containing buffer material. However, such is not the case with distilled water or with other unbuffered liquids. Distilled water is one of the most difficult materials to test for pH, the reason being that such water is free from solids and is therefore devoid of buffer action, which makes it extremely sensitive to changes during a test. This sensitivity is due especially to the absorption of carbon diox-

ide from the air. It is well at this point to mention the fact that ordinary distilled water is always acid in reaction because of the absorption of carbon dioxide. Water which has taken up carbon dioxide from the air until equilibrium has been established will contain approximately 0.3 per cent of that gas by volume, and the pH of such water should be 5.7. If this water is boiled for several minutes in a pyrex glass vessel and immediately protected against carbon dioxide with a soda-lime tube, it will have a pH of about 6.6, but the condition is very unstable. Of course, distilled water is used for making standard buffer solutions and may be used also in making pH determinations on buffered liquids with no element of error from the carbon dioxide contained, since the buffer material takes care of this small amount of acid in the manner already explained.

The foregoing remarks about buffer action hold true, of course, only within certain limits. Naturally, if huge quantities of acid or alkali are added, there will be some disturbance in the pH of buffered liquids; but as we are dealing only with liquids containing small quantities of acids and alkalis, such exceptions do not belong within the scope of a general pH discussion.

INDICATORS

Hydrogen ion determinations are made either electrometrically or colorimetrically. Electric conductivity tests for the quantitative determination of hydrogen ions require elaborate apparatus of special type; moreover, the operator should be a chemist thoroughly trained in electrophysics. The electric outfit must be housed in a way to provide temperature and humidity control and to keep it free from vibration; furthermore, it should be calibrated and checked daily. Electrometric determinations made by chemists having proper equipment are undoubtedly more accurate than colorimetric tests, but the average technician will do better with the latter. A few pieces of inexpensive apparatus, a few carefully prepared standard buffer solutions and indicators, and the ability to read directions and match colors is about all that is required to make colorimetric tests.

The principle of making pH measurements by colorimetric means is based on the fact that various indicators change in color when they are acted upon by solutions of different acidities and alkalinities. Though litmus is used extensively in quick testing for reaction, this indicator is not suitable for use in pH work because its change from red to blue covers too broad a zone in the pH scale; the pH range of litmus is from 4.6 to 8.4, which amounts to a total of 3.8, and therefore it would not give perceptible differences in color pro-

duced by solutions having pH values that differ by as much as 0.5. As we aim to work with differences of 0.1 pH, litmus is naturally unsuitable. The whole pH range from 0.0 to 14.0 is covered by a series of indicators, each having a working range of about 1.6 pH, but we need only consider here those used in the zone where most determinations occur. In the general run of cases the pH falls between 2 and 10, a range covered by the following indicators especially recommended by Clark and Lubs:

	pH	Color change		pH	Color change
Thymol blue (alkaline range).	1.2-2.8	Red-yellow.	Brom thymol blue.....	6.0-7.6	Yellow-blue.
Brom phenol blue.....	3.0-4.6	Yellow-blue.	Phenol red.....	6.8-8.4	Yellow-red.
Methyl red.....	4.4-6.0	Red-yellow.	Cresol red.....	7.2-8.8	Do.
Brom cresol purple.....	5.2-6.8	Yellow-purple.	Thymol blue (acid range).	8.2-9.8	Yellow-blue.

Note how the range of the indicators overlap, thus providing means for checking the end values in each range; for example, a solution showing a pH of 6.0 with methyl red would give a clearer test if checked with the next higher indicator, because pH 6.0 occurs nearer the central point of inflection in the dissociation curve of brom cresol purple, and testing a pH 6 with this indicator will give a better color contrast, since that value lies near the center of the range of this indicator.

All indicators in the dry form should be of special reagent quality, carefully selected for their brilliancy, and relatively unaffected by conditions other than hydrogen ion concentration. The indicators may be dissolved either in alcohol or water, though the latter is preferred. Stock solutions of the following indicators are made 0.4 per cent in strength: Thymol blue, brom phenol blue, brom cresol purple, and brom thymol blue; and stock solutions of the following are made 0.2 per cent in strength: Methyl red, phenol red, and cresol red. Place the required weight for making 25 c. c. of stock solution in a mortar and reduce to a fine powder, then make the dye water soluble by adding the following amounts of N/20 NaOH for the indicator mentioned: Phenol red, 5.7 c. c.; brom phenol blue, 3.0 c. c.; cresol red, 5.3 c. c.; brom cresol purple, 3.7 c. c.; thymol blue, 4.3 c. c.; brom thymol blue, 3.2 c. c.; methyl red, 7.4 c. c.; completely dissolve the indicator in the N/20 NaOH by triturating with a pestle, then add distilled water to make 25 c. c. For use in pH work these stock solutions should be diluted 1 to 10; the usual procedure is to take 5 c. c. and dilute to 50 c. c. Transfer the test solution to a bottle, preferably one fitted with a ground glass pipette capped with a small rubber bulb. It will be noted that the red indicators are used 0.02 per cent in strength, and all others are used 0.04 per cent in strength.

STANDARD BUFFER SOLUTIONS

The standard solutions used in the colorimetric method of determining hydrogen ion concentration are buffer solutions with such well-defined composition that they can be accurately reproduced, and with pH values accurately defined by hydrogen electrode measurements. Several sets of buffers have been proposed by recognized investigators in this field, any of which may be used with the full assurance that their pH values are correct. An excellent set easily prepared is the one proposed by McIlvaine, but as this extends from 2.2 to pH 8.0 only, it is necessary to supplement it with a short set (Clark and Lubs) to take care of values from 8.2 to 10; the two sets provide a series of accurate buffers stepped up at even intervals of 0.2 pH. The following stock solutions are required for making these buffers:

(a) *Phosphate solution*.—Accurately weigh 35.616 grams secondary sodium phosphate having two molecules of water of crystallization ($\text{Na}_2\text{HPO}_4 \cdot 2\text{H}_2\text{O}$); dissolve in distilled water and make up to 1 liter in a volumetric flask. This sodium phosphate should be of the standard commonly known as "Sorensen's phosphate." If the anhydrous salt is used in place of that containing two molecules of water of crystallization, take 28.41 grams to make 1 liter of solution.

(b) *Citric acid solution*.—Accurately weigh 21.008 grams citric acid, dissolve in distilled water and make up to 1 liter in a volumetric flask.

(c) *Boric acid-potassium chloride solution*.—Take 12.4048 grams boric acid and 14.912 grams potassium chloride, dissolve together in distilled water, and make up to 1 liter in a volumetric flask.

(d) *Sodium hydroxide solution*.—This solution is fifth-normal strength, containing 8.002 grams NaOH in a liter. Sodium hydroxide in the form of sticks or lumps contains variable amounts of water, and it is therefore not possible to obtain this quantity by direct weighing; the usual procedure is to first make a strong solution, then assay it to determine the exact weight NaOH contained per cubic centimeter, and finally dilute it to the proper strength. In other words, follow the usual method for making volumetric solutions of NaOH, a detailed account of which may be found in the Pharmacopœia and in textbooks on volumetric analysis.

All chemicals used for making the foregoing solutions should be of special reagent quality; the sodium hydroxide may be of U. S. P. quality. The stock solutions should be kept in the dark in glass-stoppered bottles, protected against mold growths by the addition of two or three drops of toluol.

The preparation of buffer solutions is simple, although care must be exercised in measuring the exact amounts of stock solutions called for in the formula:

MCLIVAIN'S STANDARDS

pH	Na ₂ HPO ₄ solution (c. c.)	Citric acid solution (c. c.)	pH	Na ₂ HPO ₄ solution (c. c.)	Citric acid solution (c. c.)
2.2	0.40	19.60	5.2	10.72	9.28
2.4	1.24	18.76	5.4	11.15	8.85
2.6	2.18	17.82	5.6	11.60	8.40
2.8	3.17	16.83	5.8	12.09	7.91
3.0	4.11	15.89	6.0	12.63	7.37
3.2	4.94	15.06	6.2	13.22	6.78
3.4	5.70	14.30	6.4	13.85	6.15
3.6	6.44	13.56	6.6	14.55	5.46
3.8	7.10	12.90	6.8	15.45	4.55
4.0	7.71	12.29	7.0	16.47	3.53
4.2	8.28	11.72	7.2	17.39	2.61
4.4	8.82	11.18	7.4	18.17	1.83
4.6	9.35	10.65	7.6	18.73	1.27
4.8	9.86	10.14	7.8	19.15	.85
5.0	10.30	9.70	8.0	19.45	.55

In each case the combined quantities of the two solutions is made up to 200 c. c. with distilled water.

CLARK AND LUBS' STANDARDS

pH	H ³ BO ³ - KCl solution (c. c.)	NaOH solution (c. c.)	pH	H ³ BO ³ - KCl solution (c. c.)	NaOH solution (c. c.)
8.2	50.0	¹ 5.90	9.2	50.0	¹ 26.70
8.4	50.0	¹ 8.55	9.4	50.0	¹ 32.00
8.6	50.0	¹ 12.00	9.6	50.0	¹ 36.85
8.8	50.0	¹ 16.40	9.8	50.0	¹ 40.80
9.0	50.0	¹ 21.40	10.0	50.0	¹ 43.90

¹ Dilute to 200 c. c.

COLORIMETRIC DETERMINATION OF pH

Having explained the meaning of hydrogen ion concentration, its relation to the pH scale, and use of standard buffer solutions, the actual work of testing may be done with a better understanding. In dealing with a subject so large in scope within comparatively few pages, it is not possible to go into the details of the many possible applications of pH work; therefore, the following is only an outline of such details as apply to pH determinations generally.

Aside from the set of standard buffer solutions and indicators already described, there is required several sets of test tubes, a few test-tube supports, and one or two color comparators. A special lot of test tubes should be on hand and used only in making pH determinations; these tubes should be of clear glass, without lip and of uniform size. It matters little about the length of the tube, but the diameter should be 15 or 16 mm.; a tube 100 mm. long and 15 mm. diameter is standard in the trade and is a very convenient one to use in this work. Permanent marks should be placed on the tubes at the 5 and 10 c. c. levels, and those tubes on which the

distance from the bottom to the 10 c. c. mark differs from the others by more than 2 mm. should be rejected. The tubes should be placed in a 12-hole test tube support, single row. An excellent yet inexpensive type of color comparator is the so-called "block comparator," made from a solid block of wood with a double row of three holes each for test tubes on the surface of the block, and with three observation holes through the side of the block, one for looking through each pair of tubes. A full description of this type of comparator can be found in any standard catalogue.

When not even the approximate pH of a given liquid is known, the first step is to make a rough determination in order to ascertain in which color series the pH of the unknown occurs. The general procedure is as follows: Transfer 10 c. c. of the unknown liquid to a test tube, add 10 drops of brom thymol blue, mix well. This indicator is tried first, since it has a pH range of 6.0 to 7.6 and therefore covers the neutral point 7.0; hence it is possible by means of this one indicator to determine whether the solution being tested is neutral, acid, or alkaline. Next, place in a test tube 10 c. c. of pH 6.0 standard buffer and in a second tube place 10 c. c. of pH 7.6 buffer; these two solutions are the end buffers in the pH range for the indicator mentioned. To each tube of buffer add 10 drops of brom thymol blue and mix well. Now by comparing the color of the unknown against these two standards it can be seen at a glance whether the pH of the unknown occurs in that range: If the color of the unknown is not of a deeper yellow than the color in the pH 6.0 tube, or not of a deeper blue than the color in the pH 7.6 tube, then, naturally, the unknown pH is within that series; on the other hand, when the unknown shows more yellow than the pH 6.0, or more blue than the pH 7.6, its pH is outside of the brom thymol blue series, and it should be retested with the indicator next in the direction toward which the trial test pointed. For example, if the first trial on the unknown shows more yellow than the pH 6.0 standard, the pH of the liquid is lower than 6.0, and it should be tried with brom cresol purple indicator; or, if on first trial the unknown shows more blue color than the pH 7.6 standard, it should be retested with phenol red. In any case compare the color against the end buffers to the pH range for whatever indicator used. After finding the proper indicator to use, set up a series of tubes with standard buffers covering the entire pH range for that indicator. Since the working range of indicators is 1.6 pH, and as the difference between consecutive values of standard buffers is 0.2 pH, it takes nine tubes of consecutive pH buffers to make a complete set of standards for any one indicator. To each tube of standard add, of course, the same quantity of indicator.

The unknown is now matched exactly against the standards, using the proper indicator and placing a tube of unknown in the middle hole, front row, in the comparator block, and back of this a tube of distilled water. In the first and third holes, front row, place standards that differ by only 0.2 pH, and back both tubes with a tube of unknown containing no indicator. The quantity of indicator used must be the same in all tubes, ordinarily 10 drops. Look through the three observation holes, holding the comparator block toward a window or other source of daylight and change the standards if necessary until the central pair of tubes (unknown and distilled water) exactly match one of the pairs on the right or left of it or until the color through the central pair lies between the color of the pair on either side; make sure that the two standards on either side of the central tubes differ by only 0.2 pH. If an exact match is obtained, the pH of the liquid tested is read off directly from the standard with which the match is made; if, however, the color of the central pair of tubes lies between the colors of the pairs on either side, the pH value is taken as the average of the two.

Note how the rear row in the double row of holes is used for "backing" when making final comparison. The purpose of "backing" is to balance the standards and unknown as regards factors that would affect the shade of color compared; these are chiefly intrinsic color and turbidity. The standards are compensated for any of the influences that the unknown may have against a clear color by placing a tube of the unknown, without indicator, in the hole back of each standard so that when looking through the observation hole the operator will look through a tube of standard "backed" with a tube of unknown. The central tube (the unknown containing the indicator) is backed with a tube of distilled water in order to have a line of observation through the same depth of liquid in all three pairs of tubes.

In measuring the indicator by the drop method bear in mind that the size of drops vary with the opening in the dropper and for this reason it is advisable to use the same dropper in any given series of tests, usually the dropper belonging with the indicator bottle in use. In some tests it may be found that 10 drops of indicator give too deep a color for close comparison; in such cases retests should be made with a smaller number of drops, beginning with five and working up to that number that will permit a close match between unknown and standards.

Since the hydrogen ion concentration of a solution depends entirely on the degree of ionization, and as the temperature has considerable effect on the degree of ionization, the influence of temperature is important and must not be overlooked. All determinations on a given material should therefore be made at approximately the

same temperature, that is, between 20° and 30° C., between these two temperatures the error is negligible. If this range of temperature is not possible, a thermometer should be used and the temperature maintained at the same point in all tests, as one determination at 20° C. can not, of course, be compared with another at 60° C.

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CHANCROIDS¹

DIAGNOSIS, AND A NEW METHOD OF TREATMENT

By J. E. POTTER, Lieutenant Commander, Medical Corps, United States Navy, and
FRANCIS H. REDEWILL, B. S., M. A., M. D., San Francisco, Calif.

Our paper covers more than the title would indicate in that we will touch on the pathology, etiology, symptoms, diagnosis, and treatment of nonsyphilitic lesions of venereal origin, including chancroid, bubo (venereal and climatic), Vincent's angina, and phagedena. There are numerous other skin lesions seen in the venereal area that may be troublesome from a diagnostic standpoint, such as very rare cornifications resulting from gonorrheal furunculosis, eczema, herpes simplex, and even smallpox, but these need not be referred to here.

There are two types of bubos usually associated with chancroidal lesions—the true chancroidal and the climatic. The literature is so full of articles on the venereal chancroid that it will not be necessary for us to say very much about this particular lesion, other than to recall that the etiological organism is the Ducrey's streptobacillus. The finding of these bacilli in the soft primary sore of the genitalia is not the only factor to be considered in arriving at the diagnosis of venereal chancroid, and does not exclude the possibility of the infection being a mixed one. With climatic bubo one very seldom finds the primary chancroid lesion.

The frequency with which mixed infections occur make early differentiation of leucic chancre of paramount importance. By applying certain types of treatment we may mask the typical features of and thus add to the difficulty in diagnosing an early case of chancre, thereby decreasing the chances of the patient's receiving early anti-syphilitic treatment. A dark-field examination should be made of all lesions of the genitalia. In the untreated lesions, this will reveal 75 per cent of the true syphilitic lesions. A Wassermann or Kahn

¹ Read before the urological branch of the San Francisco County Medical Society, March 28, 1929.

test from the serum extracted from near the lesion as well as serum extracted from the bubo will show a higher percentage of positives than if made from the blood serum in the early stage. It can not, then, be too strongly urged upon physicians or made too prominent a feature of educational campaigns that the fresh, untreated lesion is the most easily diagnosed of syphilitic lesions and, among syphilitic lesions, offers the greatest hope of a permanent cure.

CLIMATIC BUBO

There are a number of synonyms for this disease, such as sub-acute inguinal lymphogranulomatosis, fourth venereal disease, non-venereal bubo, and adenitis tropicalis. Nealon, in 1890, was one of the first to describe this lesion, and Godding, in 1896 and 1897, emphasized the nonvenereal character of the cases he observed in the British Navy.

Definition.—Climatic bubo is a distinct disease (Whitmore), characterized by the inguinal bubo, a febrile course with malaise, a moderate anemia, and a marked tendency to chronicity.

Etiology.—The disease is most frequently found in the Tropics, and an interesting feature is the fact that it is more prevalent among white people than among natives. It is also found in temperate climates. Although known as "nonvenereal bubo," it is undoubtedly of venereal origin, and every case in this series gave a history of sexual exposure to a native woman. The causative agent is not known. Heiner found gonococci in cases he reported which were no doubt typical cases of gonorrheal bubo.

There is no doubt that there is always an initial lesion, a sort of small herpetiform ulcer, which one might call a microchancre, and it may even be intraurethral. One may find, on careful examination, a minute ulcer or scar in the coronal sulcus, or the patient may give a history of a "blister" or transient urethral discharge. This lesion is insignificant and may not even be noticed by the patient. In fact, most of the patients suffering from climatic bubo have never noticed or have forgotten about the primary lesion, and only a few instances where this ulcer was observed have been reported in medical literature. The lowered resistance of the individual in a tropical climate may account for the higher incidence of this infection in the Tropics. The period of incubation varies from two weeks to three months.

Pathology.—On section, the glands cut hard and seem to be non-purulent. There is no definite soft center, as in the venereal type of bubo, and it is difficult to exude pus from the lesion. In the more advanced cases superficial lymph glands along Poupart's ligament may assume an astounding size. Butler and others have mentioned

the typical appearance of the excised glands. The parenchyma has a granular appearance and there are minute foci of necrosis. In the advanced stage the parenchyma of the gland is grayish on section and a single abscess may form from coalescence of the necrotic areas. With incomplete surgical drainage, dense scar tissue may develop with characteristic sinuses. On examination of the exudate, the ordinary pus organisms are usually found.

Symptoms.—Patient complains of general malaise with pains in the back and legs and swelling in the groin, which gradually increases in size. Temperature usually ranges from 100 to 102, but may reach as high as 104 for a few days. The bubo usually decreases slowly in size, and gradually the periglandular tissue becomes more infiltrated and the deep fascia becomes fixed to the bubo mass. Suppuration may take place with spontaneous rupture and formation of fistulæ, which may result in dense, deep scars.

Diagnosis.—We must differentiate this disease from chancroidal and gonorrheal bubos. Tuberculosis is more frequently found in other localities and very rarely primarily in the inguinal region. The same may be said of Hodgkin's disease. The absence of syphilitic, chancroidal, or gonorrheal infection, the absence of organisms, a marked chronic course, the moderate fever with lymphocytosis, and slowly developing bubo, together with the appearance of the excised periadenitis, are points to be remembered in making a diagnosis. The treatment will be discussed later.

PHAGEDENA

This condition has been confused in the past literature with granuloma inguinale, but these two diseases differ widely in their etiology, pathology, and history. Wile, in 1916, was one of the first to give a clear etiological and pathological description of this condition. He showed that phagedena is not a specific infection, but is due to a symbiosis of a number of organisms, many of which are probably saprophytes. He also stated that perverted sexual acts, with infections from mouth organisms, may be a causative factor. Robbins and Seabury believe this to be a complication of both chancroid and chancre; that the condition is very destructive in nature, and that, unless checked early, will destroy the penis. Buschke thought the organism to be a filtrable virus of unknown type. He showed that the blood cultures were negative, although the temperature was elevated and there were other signs of constitutional infection. Pearce showed that the disease often followed a dorsal split of the prepuce, presumably from phimosis, the disease spreading rapidly and destroying all the tissues. Callomon believes that there is no specific bacterial agent, and he shows that with

destruction of tissues, hemorrhage, and the development of gangrene, coagulative necrosis takes place. The disease not only destroys the genitalia, but sometimes extends up the abdominal wall. In a recent article Labadie concludes that there is no specific organism producing this disease, but that it often starts with a chancroidal infection, sometimes complicated by chancre, the original infections becoming complicated by other organisms.

Vincent's angina.—Like the characteristic trench-mouth lesions, these lesions of the genitalia exhibit markedly destructive processes with raw, punched-out, ulcerated lesions, which spread rapidly and are frequently painful. These are frequently mistaken for chancroids. The diagnosis is easily made from the history and with the finding of the spirilla at the base of the soft grayish ulcer.

TREATMENT

For the treatment of open chancroidal sores, after the diagnosis has been made, the two formulæ mentioned below have been used rather extensively in the naval service since 1924. Formula *A* is as follows:

Hydrargyrii chloridi mite.....	30.00
Zinci sulphas	60.00
Tr. opii camphorata.....	60.00
Liquor calcis	240.00

The technique is as follows:

Cut a thin layer of cotton to correspond with the size of the ulcer; saturate with solution "A," apply to lesion, cover with gauze and adhesive. Not more than three applications, once a day, are necessary, after which the ointment is applied. Formula *B* is as follows:

Zinci oxidum	30.00
Amylum.....	30.00
Acidi borici.....	30.00
Camphora	30.00
Petrolatum carbolated 3 per cent q. s. ad.....	360.00

The application of formula "A" frequently results in the formation of scales or the closure of the minute lymph spaces, aiding the anaerobic bacteria to migrate to the inguinal glands. The development of bubos was rather common during treatment by this method.

We have adopted the following method of treatment, which has given us the most gratifying results: First, the ulcer is cleansed with a weak permanganate solution or with hydrogen peroxide. A 20 per cent solution of silver nitrate is then applied, immediately followed by an application of bismuth subnitrate powder. The next day, after cleansing the ulcer, an application of an aqueous solution of 5 per cent gentian violet and 10 per cent acetone is made. These

two forms of treatment are given on alternate days for the first five days, after which the gentian violet acetone solution is used daily until the lesions are healed. Additional treatment with infra-red and the mercury quartz arc light will be discussed later.

The foreign literature, especially Italian and French, during the past few years has reported very favorable results obtained by the use of the Nicolle vaccine. The treatment consists of the intravenous injection of 0.3 cubic centimeters of the vaccine daily. Nicolle, Durant, Dubreuilh, Broustet, Gjorg-Jevitch, and Stephanovitch all report remarkable results following its use.

In the treatment of climatic bubo the tartar emetic therapy has proven the most satisfactory, especially in cases that have developed secondary sinuses. Five cubic centimeters of a sterile 1 per cent solution of antimony and potassium tartrate are used intravenously. The dose is increased to 10 cubic centimeters, and 6 to 15 intravenous injections are given at three or four day intervals. In advanced climatic bubos, also venereal bubos, wide incision and free drainage are practically always indicated.

One of the most unsatisfactory things in the practice of medicine has been the treatment of phagedena of the genitalia. We have been using a new method of treatment with which we have been uniformly successful. First of all we assume that the offending germs are anaerobic, and after applying cleansing solutions such as hydrogen peroxide and weak permanganate, application of an aqueous solution of 5 per cent gentian violet and 10 per cent acetone is made. The next step is to apply the infra-red carbon arc light to the lesions, which are now stained with gentian violet dye, for periods varying from thirty minutes to three hours, depending on the condition of the lesions and the surrounding skin area. At first we use as little ultra-violet portion of the spectrum as possible to avoid sunburning the tissues. After several treatments, when the skin is somewhat tanned, the water-cooled and air-cooled quartz mercury arc light lamps are used.

VINCENT'S ANGINA

When the diagnosis is made we usually give two intravenous injections of neoarsphenamine, as we believe this has value as a tonic. Neoarsphenamine dissolved in 10 per cent mercurochrome may be applied locally to the lesions, as suggested by Sampson in treating the lesions of the mouth. The best results from local treatment we obtained by first thoroughly cleansing the lesions with hydrogen peroxide, and then applying 5 per cent chromic acid for three daily treatments, after which we used an aqueous solution of 5 per cent gentian violet with 10 per cent acetone until the lesions were healed.

TABLE No. 1

	Total number of cases	Developed bubos	Treated with "A" and "B"	Developed bubos	Treated with gentian violet and acetone	Developed bubos	Other treatment
Chancroid.....	238	58	138	51	100	7	
Chancroid and syphilis mixed infection.	75	9	60	9	15	0	Active antisyphilitic treatment received in addition.
Climatic bubo.....	55	55	-----	55	-----	-----	Tartar emetic. Sinuses treated with gentian violet acetone.
Phagedena.....	6	3	3	3	3	0	Infra-red gentian violet acetone.
Vincent's angina.....	8	0	0	0	0	0	Neocarsphenamine used in addition.
Total.....	382	125	201	118	118	7	

CONCLUSIONS

1. In this series of nonsyphilitic infections we have discussed the differential diagnosis.
2. We consider climatic bubo a true venereal infection; the first manifestation being the minute primary genital sore.
3. In treating genital lesions, syphilitic chancre must first be ruled out if possible before any treatment is instituted.
4. The treatment described is very efficacious in various types of genital lesions and offers especially new hope in the treatment of the destructive phagedena.
5. Vincent's angina of the genitalia is frequently mistaken for chancroid, as both lesions are very similar in appearance.
6. Any method of treatment which tends to form crusts is most apt to further the development of inguinal bubos.

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CONTROL AND TREATMENT OF EPIDERMOPHYTOSIS

By D. S. O'CONNOR, Lieutenant, Junior Grade, Medical Corps, United States Naval Reserve Force

Epidermophytosis, also called dermatophytosis, "itching toes," and "athletes itch," is not unusual among people using common shower baths. Some authors place the incidence among those using public shower baths at 100 per cent. Certainly the incidence is very high. The widespread prevalence of the condition has occurred only in the past decade, and to-day many physicians are unfamiliar with

the nature of the condition and its treatment. Until three years ago the author was unable to obtain any information on the subject from Federal or State health authorities.

The author as medical advisor to a large Y. M. C. A. has had exceptional opportunities to study epidermophytosis for the past eight years. Epidermophytosis is a local disease; it is found most commonly between the toes, but it may be found on other parts of the body. Lesions have frequently been seen on the hands, sternal sulcus, intercrural fold genital region, axilla, scalp, and eyebrows.

The cause of the disease is a variety of ring worm. It apparently thrives in moisture and is found on the floors of common shower baths and about the still waters and shores of infected small lakes and ponds. The natural body oils are evidently an efficient defense against the parasites, and the site of the lesions is on those parts of the body where the natural body oils are decreased or where perspiration is excessive.

The frequency with which the disease is found between the toes is accounted for by persistence of the organisms on shower room floors. These floors are nearly always wet and the room temperature high. Conditions are, therefore, ideal for the propagation of the parasites. In walking on the floors, infected water is sucked up between the toes and is seldom removed in drying the body. The confinement of the feet in shoes and stockings gives further heat to aid the invasion by the parasites.

The principal symptom of the disease is intense itching between the toes, especially when the feet are excessively hot and perspiring, and when the shoes and stockings are removed at night. This explains why the condition is much worse when woolen socks are worn.

The rubbing of the toes in an effort to relieve the itching causes abrasion of the skin, with danger of secondary infection.

The lesions, beginning between the toes, gradually spread over the bottom and sides of the foot, but seldom spread up the leg. Lesions beginning on the hands or fingers seldom spread beyond the palm of the hand in front or the base of the fingers dorsally.

The epidemic control of this condition is possible, and to this end the following methods are suggested.

EDUCATIONAL MEASURES

Instructive placards.—Large placards giving the salient facts about the disease and the measures necessary to prevent it may be placed in conspicuous places in the locker rooms where they are most apt to be read. The following has proved advantageous:

"Itching toes" is caused by a parasite which burrows into the skin. It is an annoying condition, but not dangerous. It can be prevented. This institution is doing everything possible to prevent its members from acquiring the disease, but the cooperation of

the members using the shower baths is necessary to make those measures effective. For your own welfare and for the welfare of others observe the following precautions.

1. Walk only on the lattice walks.
2. Use your own soap and towel. Do not use a towel more than once.
3. Wear wooden sandals in the shower room and in going to and from the shower room.
4. Dry carefully between and under the toes after bathing.
5. Report new skin lesions to locker room attendant.

Lectures.—In the course of a series of lectures on medical subjects one covering this subject was found of particular interest to the audience.

Medical examinations.—The members of an athletic organization may be offered free diagnosis and examination by a member of the medical committee and then referred to their personal physicians for treatment.

GENERAL MEASURES

Disinfection of floors.—Each night after the shower rooms are closed, the tiled floors should be washed with a solution of cresol, and dried. The lattice work made of narrow strips of wood should be dried over night. Once each week the lattice work walks should be scrubbed in strong soap and cresol and if possible exposed to sunlight for a day.

INDIVIDUAL MEASURES

Use of wooden sandals.—Members should be urged to use wooden sandals. The wooden sandals should be sold at cost by the locker-room attendant.

Drying between toes.—Drying between the toes is entirely up to the individual, but after the importance of this precaution is realized by the member it is seldom omitted.

Individual soap and towels.—Towels should be collected from the lockers each day. Shower users should understand the importance of using individual soap cakes.

The measures listed above are valuable only in their observance. Intelligent and tactful supervision of the shower room until the measures given above become routine will do much to bring about the desired results. Schools and institutions where discipline is possible should be able to enforce the above measures rigidly.

TREATMENT

At the beginning of the infection the lesion can be stopped by repeated applications of tincture of iodine for a few days. After the disease has established itself, eradication is difficult, if not impossible, and requires persistence in treatment over a long period of time. Whitfield's ointment has given good results. The success of the treatment, regardless of the particular drug used, depends upon

its systematic use and strict observance of the collateral phases of treatment.

The following treatment should give reasonable freedom from symptoms, if not complete eradication:

1. Maintain the oil content of the skin at or above its average. Frequent or prolonged contact of the skin with water, especially soapy water, will deprive the skin of much oil and make the skin favorable for the production of lesions. Solvents of grease, such as gasoline and kerosene, are also certain to bring about an aggravation of the lesions. If the parts affected have been in contact with soapy water or gasoline, immediately apply a thin film of any grease such as lard, cold cream, or lanolin.

2. Before going to bed wash the affected parts and remove desquamated skin by friction; then apply Whitfield's ointment thoroughly and cover with clean white sock, if on the foot, or white glove for the hand. The covering is used to keep the ointment in contact with the lesions and to keep the bed clothing from becoming soiled. The full-strength Whitfield ointment sometimes causes a sensation of severe burning. It is well, therefore, to mix part of the ointment with an equal part of lanolin. After the skin has become accustomed to the ointment, full strength can be used.

The period during which the intensive treatment should be used depends upon the severity of the lesions. When the condition has subsided, the frequency of applications can be reduced to every second night for a few weeks, and then further reduced until it is being applied only once a week. The use of the ointment once a week should be continued for several months. Any evidence of recurrence should be an indication for a second course of treatment.

During treatment, the coverings (gloves or socks used) should be boiled after each use to kill any parasites which may lodge in them. The stockings used during the day should be changed daily.

MEDICAL SOCIAL PROBLEMS OF FOLLOW-UP AS PRESENTED BY SERVICE GROUPS

By F. McCLAUGHRY, Field Director, American Red Cross, United States Naval Hospital, Bremerton, Wash.

The study of genetic psychology, with the opening up of the field of psycho-analysis, gives to the mind the same value that chemical substances and rudimentary organs have given to mankind, and that anatomy and physiology have given to the body, the recognition that the mind has a history of its own, that the unconscious is the psychic life of the past and often the motivation of our conduct—man is not what he seems but what he does and his conduct

is merely the superficial manifestation of that same vegetative urge we began with at the beginning of time, now modified by environment, or our interpretation of environment, and which can be explained only on a basis of that which has preceded it. As in our physical, so in our mental development, we may become sidetracked or threatened with fixation—and our ability to pass completely through a normal cycle of development depends upon our potential ability of adaptation, the harmonious activity of body, mind, and environment.

Now how does this genetic approach apply to our daily work? Into our service hospitals flows a steady stream of humanity, moulded or warped by the communities out of which they emerge. Types of individuals ranging from the stable, the odd, the queer, those not wholly satisfied, cynical, bitter, overemphasized, a graded scale on down to the defective and psychopathic personalities, reaching finally the psychotics who have found too great a discrepancy between desire and attainment.

All individuals have not emerged from out this biologic pathway equipped to cope with modern civilization's onrush. Nor have all communities kept apace with the finer civilizing forces of our present day existence. Backward, ingrown communities we call them, communities that, because of geographic or climatic conditions, have lagged behind. The traditions and superstitions peculiar to the locality have moulded the thinking of the group it produces. How can we take this adult group, with their established personality traits and behavior patterns, and give to them a new viewpoint? How are the emotionally unstable to be adjusted to a new environment—what of the T. B. and surgical case who must return to an old and illy equipped environment? Have we social and medical resources which can be called upon to give them the courage to wrest from that environment the will to live?

Just a year ago we established here in this hospital our Medical Social Service Department. During the year this department has handled 209 cases—209 individuals who have presented social and economic problems, many of which have been intensified by problems of personality and behavior either on the part of the patient himself or by some member of the family having immediate supervision over him. In the original analysis of the field of hospital social work, we viewed our work in the light of three divisions, namely; the investigation as an aid to diagnosis, the adjustment in the hospital, and the follow-up in the community. During this past year our work has defined itself, the greater need appearing in the field of follow-up, the necessity of following back into the community and bringing to bear social, medical, and economic resources in our efforts

to prolong the advantages which have accrued from the expert medical care given the patient during his hospital residence. How simple would be our task if each handicapped individual could divest himself of the emotional trends, defense mechanisms and inadequate reactions which interfere with social planning, and view his problem in the light of our trained experience and judgment. Or if each community could have cast off the retarding superstitions of the past and have taken from science all of the knowledge and improvements it had to offer. Rather have we had to cope with our patient in the light of what he is, racially and individually, and not in the light of what we think he ought to be—and to view many of our communities only as a group of people, who, years ago gathered together in a geographical area by common interests, are still functioning on the traditions of their ancestors. The “if it was good enough for my parents it’s good enough for me” attitude which regards any outside elements as an invasion of their personal rights and liberties, suspicious, paranoid communities resisting scientific progress even as single individuals resist the new idea merely on the ground that it is a new idea.

Let us look into some of these communities and concern ourselves with some of these types as they pass through our service hospitals, emotionally and physically handicapped.

Case No. 1.—The patient is 17 years old. Born and raised in the Ozark Mountains, life had proven for him a most uninteresting and monotonous round of existence. The family had always lived there, perhaps for no other reason than having settled there years before and, finding life somewhat effortless, had remained. Most of them had also died there. So when his parents, although only in their thirties, “just died,” his older brother, younger sister and himself had simply moved over to the grandfather’s house, and life resumed the even tenor of its way. He attended school until about the 10th grade, when, “tired of studying,” he left school and worked about the community at odd labor jobs. He had always felt, however, that something more interesting and exciting lay beyond the Ozarks; so when Navy life was painted to him in glowing colors by the recruiting officer, he had enlisted—then only 16 years of age. In 10 months he had made his rating of seaman, 2d class, and, obtaining a furlough, returned home, no doubt to display his uniform and to exhibit his newly acquired knowledge. During his furlough he received a wire canceling the remainder of his leave and ordering him to return immediately to his ship. He was without funds at the time and, fearing disciplinary action were he to delay, jumped a freight train and remained undetected until the freight reached a junction, where he endeavored to climb out. Tragically for him, the freight backed and both legs were amputated below the knees.

After about three weeks' care in the railway's hospital he was admitted to this hospital and remained here for 15 months. No patient ever had better care—all with whom he came in contact endeavored in every way to aid him in making his adjustment, recognizing clearly the problems which faced a man with a physical handicap such as this. For a time he responded, but as the novelty of attention began to wear off he began to realize that never again would he move freely about and take from life all that it had to offer. He was beginning to awaken from an emotional trauma, during which time his ego had been lulled by the constant attention he was receiving. The quiet of the surgical ward, the kindly optimism of his surgeon, had provided him with a sheltered environment with which he at no time came in conflict.

As his condition improved and he was able to get about the hospital, we began to notice a marked difference in his reactions. What was his potential ability of adaptation? Was he going to be able to take from his present environment all that it had to offer or was he going to permit this trick of fate to mold him in such a way that it would be impossible for him to fit into any environment? The dances at the Red Cross house seemed to definitely establish a defense mechanism. As an onlooker only, he seemed too fully aware of there being no place in the dance for him, and his attitude toward the girls, who would sit out dances with him, became bombastic and finally so disagreeable that, in spite of a real liking for him, they one by one dropped away. We realized that this type of environment was too competitive a thing and one which drew too heavily on his now limited personality resources. What, we began to ask ourselves, were his personality resources? What had his environmental and heredity background equipped him with? Life in the Ozarks had been a stereotyped environment, like a daily round, making but few demands on him and obviously not a competitive existence which would develop any possible innate resources. His environment had given him little—what had his heredity equipped him with? Not much could be learned of the family, but our later contact with the brother and grandfather led us to believe that possibly the physical and emotional tendencies with which our patient was endowed were fertile soil for the present personality reactions. The brother, when contacted, responded emotionally to our view of the situation, expressing a desire to aid, but each step in obtaining assistance meant constant pressure and checking up; obviously an emotionally unstable type interested only for the moment, his judgment one-sided and tossed about by the immediate idea, and consequently unable to plan with us constructively toward a definite objective for his brother. The investigation in the home of the grandfather, apparently afraid to have our patient home,

refused to furnish him with funds for his return. The family as a unit did not exist; there had been no family circle to tie together these individuals and form a background for later constructive social interrelationships. Heredity seemed to offer only a constitutional inadequacy.

Our personality study of the patient, with the aid of his own insight, showed us an inadequate type, shy, normally interested in people but finding it difficult to make new friends; lacking in self-confidence, willing to cooperate, wanting some leadership, but not a great amount of responsibility. We appreciated the fact of his having reached only the post-adolescent years—the age of ideals and the striving toward great attainment—one of the periods in life when values are still nebulous and character still in the making. Even the most stable, well-disciplined being experiencing a physical and psychic trauma such as this would find his powers of adaptation and adjustment heavily drawn upon.

The positive element on which we endeavored to build was his hopefulness, that age-old expression of the *elan vital* in us which Bergson calls "that vital urge which makes us grow, and transforms this wandering planet into a theater of unending creation."⁷ We recognized the bitterness, the cynicism, the bombast indulged in by our patient as being only the manifestation of his conflict between desire and attainment. Now was the time when we must divert this energy from a destructive level, which an early paranoid reaction was expressing, to a constructive level which would enable him to realize that society was not responsible for his present unhappy condition but still had much to offer him. His old environment can give him nothing. Were we to return him to his home with no future, we might fully expect that he would become either a social menace or an indigent in the community. Vocational rehabilitation must be obtained. Fortunately the State of Arkansas proved to be one in which social legislation has been instituted. Our patient's problem was taken up with the State board of rehabilitation, and although we were unable at the time of his hospital residence to work out a training program because of his own inability to plan with us, we were able to guide his thinking and to establish a definite contact with the supervisor of the board of vocational rehabilitation, who arranged to assume supervision of our patient immediately on his return to Arkansas.

Even in this stage of our planning, personality reactions again interfered. We had endeavored to conserve his travel pay and allowances given him at the time of his discharge from the service, following which he had been retained in the hospital as a supernumerary, but unknown to us he purchased a car, intending to drive back to Arkansas. He had now been fitted with artificial limbs and had

become fairly adept in the use of them, and having reached maximum hospital improvement was discharged from the hospital, unfortunately in the absence of the social worker. Taking his car, he proceeded as far as Eugene, Oreg. Having no funds, he endeavored to obtain work and experienced his first rebuff in attempting to make his own way. He returned to Bremerton, hoping to be readmitted to the hospital, and when we located him he was sleeping in his car and had been without food for two days. He had lost weight, and was in a markedly depressed state of mind, feeling that life for him was a hopeless affair. We arranged his care and transportation home and at the time of leaving he was looking forward with a greater degree of interest than ever before toward starting anew.

At present he is under the supervision of the midwestern branch Red Cross, who from their office in St. Louis are endeavoring to gather together the various threads of social organization to maintain him while in training. No aspect of the problem will be ignored—personality reactions, community attitudes; all will be considered and follow-up will not be relinquished until he is safely started on a definite plan of adjustment.

The conditions surrounding follow-up on T. B. cases present our gravest problem. Why does military life seem to draw so many of its recruits from the most inaccessible corners of our country? Social problems seem always to develop where social legislation is unheard of. Impoverished communities clustered around the village store and post office; the postmaster draped in the shining mantle of his office becomes the fount of all wisdom and in many instances is the only individual on whom we can call for investigation. Again we may find a county health officer—which, relatively speaking, is a real find—an individual who, unaided, is carrying the health load of an entire community, ready for call at all hours, in all kinds of weather, out over mountainous roads, with no medical resources other than that which he carries in his bag. His patients, perhaps, should have hospital care or special diet, prolonged rest, but since each one of the family is doing his share toward wrestling a bare living from out their patch of land, these things must be set aside or postponed. No social resources here to become the controlling factor in the situation. We are again back in the scale of time—nature alone is the controlling element. Only the better equipped will live; the weaker will go under.

Case No. 2.—It was out of just such a community that this patient entered the service, 18 years of age, the oldest of eight children. A maternal uncle and aunt had died of T. B., also the paternal grandfather, and so we find our patient endowed with a defective constitution—a potential case at the time of his entry into the Navy.

He successfully performed his duties for a year and a half, making his rating of fireman, 1st class. Although disturbed by an occasional cough, he had minimized his symptoms and at the time of his admission to this hospital was in the advanced stage of the disease. He was discharged after prolonged hospitalization and returned to his community. Again we must work through one of our branch offices, which, with its service spread out over the country, is aware of any social resource, no matter how inadequate, that may be called upon. In this instance it was the county health officer, who had known the family for many years. T. B. had always existed in the family. The patient, in the active stage of the disease, returned to his home, a house of 2 rooms, where 10 people lived.

What are we to do with these individuals? Retaining them in this unfavorable climate is impracticable and often precipitates a depressed mental attitude; and weary of hospital routine and inclement weather, the patient wears down his resistance in his desire to get away. Often here we find the same vital urge which acts as a constructive force in one instance acting as a destructive element in another. The patient is confident that when he gets home his condition will improve, but away from constant medical care, the rest periods and careful diet, and driven by an urge for action, we fear for his future without some supervising agent in the community. Our nursing service will reach out and cooperate with the local health officer in an effort to aid him in bringing about a partial adjustment between the patient and his environment. No personality reactions here to hinder our social planning, but a community blocking the advance of modern thought.

There are other cases which pass through our department in which we see the personality reactions of the parents dominating the situation and in many instances upsetting the plan of the social worker. Immature emotional trends acting as determinants in the parents' decision as to what course will be followed in the social plan, the patient becomes a pawn between them, while they find in his misfortunes an outlet for their own unsolved emotional problems. This is illustrated in the following T. B. case.

Case No. 3.—The patient, a splendid cheery individual, had been in the Navy three years. Having come in with an ambition to advance as rapidly as possible, he soon made his rating of seaman, 1st class. Life was joyous and the Navy a happy place to him. The military discipline stimulated rather than irked him, and his pride in his ship and officers was a pleasure to see. According to him it was just his "hard luck." "a bad break" that admitted him here with an advanced case of pulmonary T. B. We felt a considerable satisfaction in finding that his family lived in a southern climate conducive to the arresting of a condition of this kind. There seemed

to be no social problems to block the plan, which was to retain him here until he had improved sufficiently to make the trip home. Then with his travel pay and allowances he could proceed, and under the care of his parents and the supervision of the local Red Cross chapter try to find his way back to his former good health. At home no economic need would be experienced and, pending the award of his pension, we felt there would be no disturbing element entering into the situation. He cooperated to the fullest, religiously observing rest periods and diet, always anticipating the time when his condition would permit the exertion of the train trip home. Even this, he was cautioned, would reduce his energies, and every ounce of energy counted.

Our plans crashed suddenly when we found his parents had decided to give up their home and had written him for funds sufficient to make the trip here by motor. On their arrival we realized that rather than an asset in our plan they were decidedly a liability. With considerable emotion they expressed their great concern over his condition. "All of their lives they had sacrificed their own interests to his ends"—now, this had occurred, and what were we going to do about it! The mother, in an hysterical manner, explained that she was "extremely nervous" and any "undue excitement" was apt to result disastrously. Her husband assured us that she became "quite hysterical." The father described himself as a newspaper correspondent. He was up here "looking into a new field of writing," and from a few moments interview one was inclined to feel that most of his career had been devoted to "looking into new fields." An inadequate type, never quite making the grade; not his fault, of course, but "due to the peculiar circumstances," as he expressed it.

His son's illness, from his way of thinking, was unquestionably due to negligence on the part of the naval authorities; he would "probably sue the Government." The entire interview was one of high emotional tone. The unexpended energy of their own inadequacies found an expression in the fancied inadequacies of others.

The family and our patient are now touring the country. Twice we have caught up with them and endeavored to establish follow-up contacts. Our Denver chapter reports that when last interviewed they had advised "that as they were not used to the cold climate, they were moving on to Phoenix; where they would stay a few weeks and then go to California." And so while the nomadic proclivities of the unstable parents are finding an outlet, our patient, an advanced case of T. B., continues to be dragged about the country.

In considering our final case one is impressed with the futility of social organization and planning without appreciation of the behavior pattern of the individual.

Case No. 4.—A seventeen-year-old sailor fell from the side of his ship onto the dry dock. He was brought to the hospital, where an examination showed both wrists and a hip broken. He remained here for six months, at the end of which time, able to get about with the aid of a cane, he was given a medical discharge and returned to his home in Des Moines, Iowa. His pension claim was filed at the time of his departure, and his condition and return to the community called to the attention of the Des Moines Chapter, American Red Cross, requesting follow up.

This chapter has been outstanding in its intelligent cooperation on numerous cases, and we felt a sense of considerable relief in being able to turn this case over to them for supervision. At the time of their first visit to him there appeared to be no immediate problem. He was convalescing normally and had not yet made an attempt to obtain employment. Although the family were of marginal circumstances, they were desirous of his waiting a little longer before attempting to work in his handicapped condition. His pension was pending, and he anticipated no difficulty in obtaining employment, feeling, with all the optimism of youth, that everything would turn out nicely—nothing could ever put him out of the running.

After a time we received a letter from him telling us that his leg was paining and he was finding difficulty in obtaining employment. He needed clothes, and his father was working only three days of the week. He was beginning to feel the stress of his environment and to become apprehensive over the future, recognizing that with his present physical handicap there would be no chance of his competing with the able-bodied individual. He felt that society was at fault. Our chapter took charge of the situation and had him examined at the orthopedic clinic of the Des Moines Health Center, where it was found that there was considerable deformity of the wrists and that he had very little grip in either hand. There had been no union at the hip joint and a considerable overriding; this resulted in much shortening. This was also a very crippling deformity and one which would prevent him from doing any work which required him to be on his feet.

Meantime the patient's bitter attitude towards society had progressed. He began to spend the time which hung heavy on his hands in company none too good, and recognizing the possibilities of a man in this condition easily developing criminal tendencies, he was referred to the neuro-psychiatric clinic of the health center. Here a psychological test found him to be of average intelligence. A personality study showed him to be wholesome, ambitious, overanxious, impatient, with no vocational limitations other than physical.

Operative correction and immediate vocational training were recommended to prevent the fixation of the developing anti-social

attitude. His pension award of \$30 per month was not sufficient to enable him to maintain himself, and his average intelligence did not equip him with sufficient perspective to make him appreciate that, although the accident had occurred while in the service, this could not be considered a basis for an antagonistic attitude toward the Government.

Our Des Moines chapter endeavored to obtain his cooperation in going to a Government hospital, but he refused. The social worker in the chapter was unable to overcome this attitude, and after considerable pressure was brought to bear, arrangements were made with the health clinic for the operation to be performed.

Just now he sees no further than each day's events but the Des Moines chapter is on hand ready to stimulate him to a greater ambition and, with the aid of the surgical clinic and the State Board of Rehabilitation, to start him along lines that will enable him to become a possible asset in his community. Here we find the highest type of medical and social organization involved in a struggle with unhappy personality reactions, which are a part of this man's behavior pattern and which must be overcome before our social plan can be consummated.

But all of our cases have not presented these difficult situations which had to be overcome. Of 25 cases now under supervision in the community more than half have responded to the social plan. T. B. cases have been hospitalized or are being passed regularly through clinics; Red Cross nurses are calling on patients in our out-of-the-way communities, and cardiac cases are receiving continued supervision. The work has been developed through our organization of Red Cross chapters throughout the country, which, by utilizing their own resources and the resources of the community, have adjusted many economic and medical problems which have arisen—family problems of inadequate wage, illness, desertion and brutality, all of which have distracted the man now in the service. Knowing that he can not leave his duties to adjust these situations, his efficiency is lowered by these outside elements. Twenty-three men have been released on special-order discharge because of dependency, and families have been aided in locating missing sons—always a constant interaction between the hospital, the man, and the community.

We find in our social work these ever present problems of adjusting personal relationships, for so have we defined the field of social work—"the adjusting of personal relationships, the relation of man to man and of man to society." By means of our social technique, which we have acquired by our own genetic approach to the social problems which lie before us, we endeavor to gather together the threads of our social organization, and into the torn fabric of our

patients' lives weave anew a texture of ambition and hope. There must be many patterns in our human workshop, shades and designs to be blended together into a harmony of tone and color which will bring about the same harmonious interaction between the organism and its environment that has marked life's progress through time.

THE LABORATORY CONSULTANT

By G. B. DOWLING, Lieutenant Commander, Medical Corps, United States Navy

Within recent years the increased volume of work at hospitals has resulted in a more complex organization, with the creation of new departments and a higher degree of specialism. Some of these newer activities have not been very generally understood or clearly defined as to scope and as to interrelationships with other departments.

The rapid introduction of new laboratory procedures has added to the necessity and importance of a laboratory consultant at the larger hospitals. This position is filled by a member of the staff, usually the director of laboratories, who is qualified by special training in clinical and pathological laboratory work to advise other staff members in regard to the selection of diagnostic and functional tests in a given case, and to interpret for them, the results of these tests. He is a sort of liaison officer between the laboratory and clinical activities.

Through current literature and by other means he keeps in intimate touch with the latest advances in the laboratory field and is responsible to the surgeon and internist in giving to them the benefits of this information.

The clinical staff members also have certain duties toward the laboratory consultant. The internist should consult with him at the bedside, so that he may have the advantage of personal observation of the cases and may furnish expert advice in regard to laboratory procedures. This arrangement, not only permits the laboratory consultant to gain additional knowledge of the cases, but humanizes for him his otherwise strictly technical problems.

The surgeon should invite him into the operating room to witness cases where biopsies may be indicated or other laboratory procedures may be of value. Bedside consultations with the surgeon have the same mutual advantage with the same ultimate benefit to the patient that derives from bedside consultations with the internist.

An extensive service in laboratory work brings increasingly the impression that medical men in general fail to utilize the resources which the laboratory offers for the benefit of the patient and the organization.

The laboratory officer frequently has no knowledge of a case of suspected sarcoma of the humerus until specimens are submitted for frozen section or for routine pathological examination. Since the final diagnosis rests with him in such a case, he should at least have had as much opportunity of seeing the clinical side of the case as the X-ray man has had. He would have, incidentally, much more interest in the sections if he had been in personal touch with the case.

In cases of suspected pernicious anemia he would be much more interested in the blood smears and his opinion would be much more valuable if he had an opportunity to observe the patient and study the charts.

Although a laboratory officer must be a trained technician, this experience may be used largely for purposes of training his subordinates and supervising their work. His interest in and knowledge of a much broader field of medicine must be maintained if the other staff members are to regard him as a medical consultant rather than a technician.

It appears very desirable at the larger naval hospitals that the officer in charge of the laboratories be ex officio a chief of service on a par administratively with other chiefs of service, and as such to be sought in consultation when questions pertaining to his special work are at issue.

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CLINICAL NOTES

COCCIDIOIDAL GRANULOMA WITH REPORT OF CASE ¹

By H. E. RAGLE, Lieutenant Commander, Medical Corps, United States Navy

Coccidioidal granuloma is a serious disease caused by the specific fungus *Coccidioides immitis*. It is generally said to be rare. Since 1892, 90 cases have been reported in literature, which are only a fraction of the number of cases that have occurred, according to hospital and clinic records. There have been five cases in the San Francisco clinics during the past few months. Several doctors recently reported seeing a number, mostly Mexicans in southern California; and that the county hospitals always have one or two cases.

The majority of the cases reported have been from California, but the disease has a wide distribution and has been reported from Argentina, Mexico, Alaska, Pennsylvania, South Carolina, Illinois, Texas, New Mexico, and Arizona. Most of the cases have occurred in adult males of the outdoor working class. Eight children and six women have been affected. One clerk, one physician, one medical student, one soldier, and one man of wealth are among the reported cases. No race or nationality is immune.

The avenues of infection are through the skin, the respiratory and the gastrointestinal systems. The incubation period is not definitely known, but experimentally in animals it is from 10 to 14 days. Nothing concerning the natural habitat of the coccidioides other than in the human body is known. Animals and certain insects are suspected. In this country most of the reported cases have been traced to the San Joaquin Valley in California.

Coccidioides immitis grows well on all artificial media containing carbohydrates. A white cottony growth appears in two to three days (fig. 2). Aërial hyphae are produced which penetrate the medium and cause the growth to be extremely adherent. As the culture ages it takes on a brownish color. Sugars are not fermented. Gelatin is slowly liquified; milk slowly peptonized. A membrane is formed over the top of the broth in which flakes are seen. In hanging drop preparations branched septate mycelia which form an intricate net work are seen. There is no budding. In

¹ From the Medical Service, U. S. Naval Hospital, Mare Island, Calif.

old cultures Ophüls (7), (8), Mac Neal and Taylor (5) have observed chlamydospores within and at the extremities of the hyphae. This has been the experience in our laboratory.

In tissue the organisms do not form mycelia but appear as spherical double walled bodies from 15 to 50 microns in diameter. These bodies become filled with endospores. (Fig. 1.) The capsule bursts, liberating the spores which in turn produce new bodies. It is from these that the hyphae are produced in artificial cultures. The chlamydospores of artificial cultivation resemble the spherical bodies found in tissue and when transplanted grow in the same manner. There has been a great deal of discussion concerning the classification of this organism, but the concensus of opinion is that it belongs to the ascomycetes. It stains with most of the common dyes, but is best demonstrated by the Romanowsky stains, preferably Giemsa's. The bodies can be seen very well in a fresh yet unstained preparation of the exudate from lesions.

The pathology is that of the granulomas, more closely simulating that of tuberculosis than any of the others. One patient seen in San Francisco hospital had a leg amputated for a supposed tuberculous knee; however, sections showed the presence of *Coccidioides immitis*. One pathologist in checking over some old pathological material labeled tuberculosis found one to be coccidioides. The organism is disseminated by both the blood and lymph streams thereby infecting practically every organ of the body. Necropsy material from such cases grossly has the appearance of general miliary tuberculosis. Histologically it is the same with the exception of finding of the coccidioides. Necrosis of bone, subcutaneous abscesses connected with deeper structures and enlarged lymph glands are common. Infections of the skin were at one time thought to be rare, but seem to be on the increase. The lesions have a verrucous appearance and grow to be of considerable size. The organism can easily be demonstrated either by biopsy with section and culture or in the exudate from the lesion. Wherever the initial lesion, sooner or later, it tends to become a generalized infection. The lungs are very quickly infected and are probably the most frequent portals of entry. There is also great predilection for bone.

The diagnosis is made by the finding of the *Coccidioides immitis*. The general signs and symptoms pertaining to some particular organ involved may be observed in addition. In the respiratory infections a differential diagnosis must be made from pulmonary tuberculosis, pneumonia, empyema, and other fungus infections. Bone involvement is easily confused with tuberculosis. The X ray gives a picture which is not distinctive. (Fig. 3.) Osteomyelitis and arthritis must be ruled out. Central nervous-system infection must be distinguished from the other meningeal infections. The skin lesions

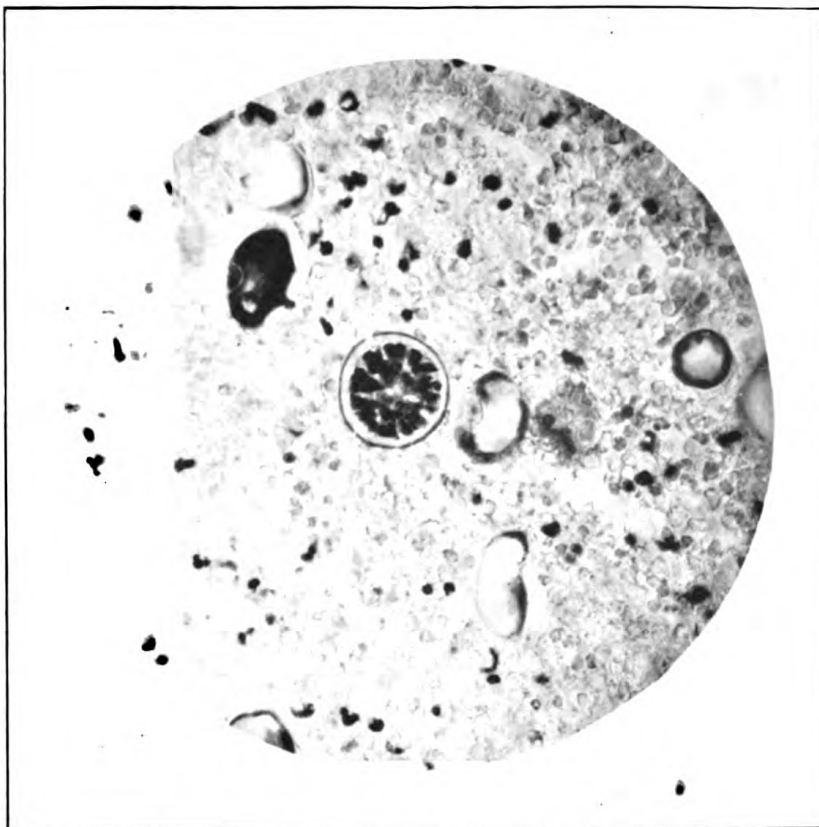


FIGURE 1.—COCCIDIOIDES IMMITIS (450 DIAMETERS) IN TISSUE. ONE IS FULL OF ENDOSPORES. (RAGLE)

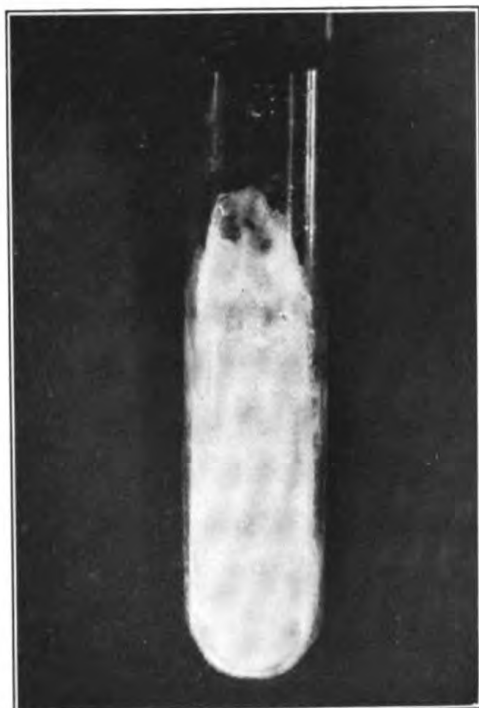


FIGURE 2.—CULTURE OF COCCIDIOIDES IMMITIS SHOWING COTTONY GROWTH. (RAGLE)



FIGURE 3.—X RAY OF SKULL SHOWING BONE DESTRUCTION DUE TO COCCIDIOIDES IMMITIS. (RAGLE)



FIGURE 4.—X RAY OF SKULL IN SAME CASE AS FIGURE 3.
(RAGLE)

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might be confused with lupus vulgaris, blastomycosis, actinomycosis, sporotrichosis, and nocardia. The blastomyces greatly resemble coccidioides in appearance but multiply by budding instead of sporulation. It is quite possible that some cases of blastomycosis upon more careful examination might have been coccidioidal granuloma. Gland involvement must be differentiated from tuberculosis, syphilis, lymphatic leukemia, Hodgkin's disease, and lymphosarcoma. In all suspected cases sputum, pus, or tissues should be examined both microscopically and culturally.

The prognosis is grave. Less than 10 per cent of the reported cases have been cured or arrested. When once the infection becomes disseminated death is certain. The majority of patients have died in from a few weeks to several years.

A great many drugs have been tried in the treatment of this condition. Potassium iodide has no effect, although it is efficacious in the other fungus infections with the exception of nocardia (15). Arsenic preparations and vaccines from old cultures are useless. Weak solutions of thymol are effective in the test tube, but the same concentration in the body has no effect. Two recent cases appear to have been markedly benefited by tartar emetic, 2 to 8 cubic centimeters of a 1 per cent solution being given intravenously on alternate days followed by X-ray treatment of local lesions. They are both living more than two years after infection; and one at regular intervals takes a course of treatment (2). Dr. H. P. Jacobson (14), of Los Angeles, reports favorable results from copper colloid preparations given intramuscularly. The best results have been obtained by amputation in cases of localized lesions favorably located (1), (2), (3).

Nothing can be said in the way of general prophylaxis. Great caution should be used in caring for cases. Cultures are dangerous in that the cottony growth is very light and is easily blown about by air currents. Spores in a dry condition for two years have been known to grow. One student working with cultures is believed to have contracted the disease in this manner (2).

CASE REPORT

CASE 56798.—An Armenian, age 42, dentist by profession, was admitted to the Naval Hospital, Mare Island, December 22, 1928, complaining of weakness, headache, swollen glands of the neck, and pain in his shoulders.

Family history.—Of no bearing.

Past history.—Frequent sore throats, otherwise negative.

Present illness.—Eight weeks prior to admission he was in a Fresno (Calif.) hospital, with influenza and broncho-pneumonia for a period of 19 days, but had never completely recovered. The glands of his neck started to swell at that time and gradually became larger and more painful. He became tired and short of breath upon the slightest exertion; had a moderate cough and night

sweats; lost 20 pounds in weight during the past two months. For the past month he had evening headaches and his appetite was poor.

Physical examination.—Abnormal findings: Small indurated mass over right zygoma. Anterior and posterior cervical glands slightly enlarged. Pulse, 120 at rest; temperature, 100.5.

Lungs: Increased whispered voice sounds over upper right lobe posteriorly.

Laboratory findings on admission.

Urine: Trace of albumin.

R. B. C., 4,970,000; W. B. C., 10,000; 72 per cent Polys. Kahn negative.

X-ray examination of chest showed a moderate amount of old scarring.

1-14-29, small retropharyngeal abscess was drained.

1-22-29, developed an abscess on the top of his head. Sputum was repeatedly negative for the tubercle bacillus.

1-24-29, abscess on top of his head was opened and drained, from which *Coccidioides immitis* was obtained both by culture and by section of a small piece of sloughed tissue. (Figs. 1, 2.)

1-31-29, blood culture was negative after seven days' incubation.

2-6-29, potassium iodide had been given in large doses for the past three weeks but had no effect. X ray of skull showed extensive erosion of bone. (Figs. 3-4.)

2-13-29, developed an abscess in his left ankle.

2-20-29, abscesses in right palm and shoulder aspirated, the pus from which showed coccidioides by direct smear. Tartar emetic was prescribed intravenously three times a week. Throughout the course of his illness his temperature ranged from 102-104; pulse, 120-140.

2-25-29, developed more abscesses in scalp and the glands of his neck broke down.

3-4-29, died. Permission for a necropsy was not obtained.

SUMMARY

1. Coccidioidal granuloma is not rare.
2. It has a wide distribution. It is more prevalent in California than elsewhere; or the doctors there are more familiar with the disease, thereby recognizing it more readily.
3. It closely simulates tuberculosis, for which it might be easily mistaken.
4. Nothing is known of its natural habitat or the mode of infection for man.
5. When once the infection has become general in the body, the prognosis is fatal.
6. Early surgery and tartar emetic are the best treatments devised up to the present time but leave much to be desired.

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JAPANESE SCHISTOSOMIASIS

REPORT OF A CASE IN WHICH THE DIAGNOSIS WAS MADE FOLLOWING AN APPENDECTOMY¹

By J. HARPER, Lieutenant Commander, Medical Corps, United States Navy

Japanese schistosomiasis, also known as Katayama disease, and in its early stages urticarial fever or Yangtze River fever, occurs in China, Japan, Formosa, and possibly the Philippines. It is caused by a trematode (flake), *Schistosoma japonicum*, which differs from the other human schistosomes by not having a tuberculated skin and having an egg without a definite spine. A fresh water snail or mollusk acts as the intermediate host and according to Bartsch the known mollusk hosts of this oriental fluke belong to the two genera, *Katayama* and *Oncomelania*.

The infection is usually contracted by wading or bathing in water infected with the cercarial or infective stage of the fluke. This may occur at any season of the year which is warm enough for the active life of the intermediate host. In some regions, as in South China and some portions of the Yangtze Valley, this may be at any time of the year. In most of the Yangtze Valley and in Japan, however, infection during the winter is practically impossible, and the months from May to October are the ones when most infections occur.

The incubation period, according to Laning, is from 24 to 48 hours. Faust and Meleney question this short incubation period and cite several cases with longer incubation periods, including their own case—an American naval officer who had no symptoms until about 28 days after infection. They conclude that the incubation period of this disease is not yet definitely established.

Clinically the disease can be divided into three stages. The explanation of the symptoms produced is based upon the pathological anatomy and physiology.

In the first stage, that of invasion and maturation of the parasite, there are usually malaise, urticarial, pulmonary, and febrile mani-

¹ Read before the Helminthological Society of Washington, D. C., Apr. 20, 1929.

festations. The urticaria and associated edema, which may last from one day to two weeks, are undoubtedly due to the reaction of the human body to a foreign protein. After several weeks the next stage sets in.

The second stage occurs during egg deposition and extrusion, the eggs showing in the bloody mucus which caps the stool. This is the stage of acute local symptoms. The malaise and fever continue and the abdominal symptoms vary in intensity. In the case of a single infection, after a variable period from 3 to 10 weeks, the temperature falls slowly by lysis and the patient slowly regains his health. However, in severe infections and in cases of reinfection, there may occur, in six to eight months after infection, enlargement of the spleen and liver.

The third stage is that of tissue proliferation and repair, in which there may be cirrhosis of the liver, ascites, cachexia, and death. Faust and Meleney state that no cases of Japanese schistosomiasis in Europeans or Americans has progressed as far as the third stage. Observations on this stage have been limited to cases among natives of endemic regions, most of whom have been reinfected many times.

The diagnosis is definitely established by finding the characteristic eggs in the stool. Other laboratory procedures recommended as an aid in diagnosis are: 1. Finding of eosinophilia. 2. Complement fixation test. 3. Intradermal test. 4. Blood serum aldehyde test. 5. Precipitin test.

Treatment consists in the intravenous administration of the specific—tartar emetic. When a case is intolerant to tartar emetic or has veins too small for intravenous medication, emetine has been recommended.

The writer has been able to find only three cases reported in which the diagnosis of schistosomiasis was made by a pathological examination of the appendix. Two were cases of *S. haematobium* and one was *S. mansoni*.

(1) Burfield and Shaw's case, a man aged 36 years, who returned to England from South Africa to have an operation for a right gluteal sinus. The appendix was removed in part and showed eggs of *S. haematobium*. The patient had returned home before the diagnosis was made and the stools were not examined.

(2) Bailey and Bullard's case, a woman aged 25 years, who had lived in South Africa until 15 years of age. She was operated on for a gynecological condition and chronic appendicitis. The appendix showed eggs of *S. haematobium*. The stools were negative.

(3) Plaut's case of a West Indian colored woman, age 26 years, in which the appendix was removed at the time she was operated on for a gynecological condition. The eggs of *S. mansoni* were found in the appendix and afterwards in the stools.

REPORT OF CASE

History.—C. A., Q. M. 1 c., U. S. N. Born in Sioux City, Iowa, December 1, 1903. Enlisted at Omaha, Nebr., December 1, 1919.

Was on duty aboard the U. S. S. *Elcano* (Yangtze River patrol), from May, 1920, to November, 1921. While on this duty he frequently bathed and swam in a group of lakes at Ichang, China, about 800 miles up the Yangtze Valley from Shanghai. This was the only duty the patient had in the Orient or in any other place outside of the United States. The patient is positive in his statement that he never had fever, urticaria, pulmonary symptoms nor illness of any sort during this tour of duty. At no time has there been a history of loose stools or stools containing blood or mucus.

In 1926, while stationed at Dahlgren, Va., he developed a dull pain in the lower right abdomen, especially noticeable after eating or exercise.

In 1928, while on duty at the Naval Torpedo Station at Newport, R. I., he was admitted to the sick list with a diagnosis of chronic appendicitis and was transferred to the Newport Naval Hospital, where an appendectomy was performed. After an uneventful recovery he was returned to duty. Patient states that he felt considerably improved following the operation but still continues to have some discomfort in the lower right abdomen after eating.

Pathological examination of the appendix made by Lieut. Commander E. E. Smith, Medical Corps, United States Navy, United States Naval Medical School, showed the presence of the eggs of *Schistosoma japonicum*. The eggs were abundant, usually occurring in clumps of 10 to 12 and chiefly in the submucosa. They were oval in shape, without spines, and measured 38 by 58 microns. Some contain only amorphous material, others clumped, centrally located, chromatin staining bodies. Except for a certain amount of fibrosis there was no marked inflammatory or foreign body reaction surrounding the eggs. The gross appearance of the appendix was negative.

The diagnosis of Japanese schistosomiasis having been established by the pathological examination of the appendix, the Bureau of Medicine and Surgery had the case admitted to the United States Naval Hospital, Washington, D. C., for thorough study. The question naturally arose as to whether or not the disease, after eight years' standing, was still active and required treatment.

While under observation (November, 1928–March, 1929) examinations showed the following:

Physical examination.—Patient in good general condition and negative except for a general glandular enlargement. Excision and pathological examination of an axillary gland showed a nonspecific chronic lymphadenitis. The liver and spleen were normal in size. This physical examination included an X-ray study of the gastro-intestinal tract, heart and lungs, a proctoscopic examination and liver function tests—all negative.

Laboratory examination.—Feces: All specimens were normal in consistency and negative for blood and mucus. An egg of *Schistosoma japonicum* was found in each of four separate stools after concentration. The following procedure suggested by Meleney was also carried out:

"If eggs can not be found on a straight smear, a specimen of feces should be washed many times in normal saline until the supernatant fluid is clear, and then transferred to tap water and allowed to stand overnight. If eggs are present, the miracidia will hatch and can be seen with a hand lens, swimming near the surface of the water. They can be poured or pipetted off into a petri dish and identified under a dissecting microscope. If the washed specimen is placed in an Erlenmeyer flask, the area to be searched at the top of the flask is small and the presence of a very few miracidia can be detected."

In this connection it may be mentioned that we were unable to develop the miracidial stage of the fluke in the stools examined. The eggs apparently were not viable.

The eggs found were oval, with a smooth shell, devoid of spine, the outlines of an embryo could be made out, and they averaged 60 by 87 microns in size.

The eggs of *Trichuris trichiura* and the *Endamoeba coli* were also found in the feces on several occasions.

Blood count.—The blood on three separate occasions showed an eosinophilia ranging from 10 to 14 per cent—otherwise negative.

Complement fixation test.—While the results of the various methods carried out proved negative, a discussion of the procedures, results, and interpretations are given, as they bring out several points of interest to laboratory workers. Through the courtesy of N. H. Fairley, Hospital for Tropical Diseases, London, we obtained an antigen consisting of an alcoholic extract of cercarial livers with which the following tests were performed:

(1) Fairley's complement fixation test given in the Journal of the Royal Army Medical School, Volume XXXII, No. 6, June, 1919. There was no inhibition of hæmolysis in any of the tubes. Result, negative.

(2) Fairley's technique in which the patient's serum was not diluted (not diluted four times). Complete inhibition of hæmolysis was obtained in tube 1 (three M. H. D.'s of complement). Partial inhibition in tube 2 (five M. H. D.'s of complement). No inhibition in tube 3 (seven M. H. D.'s of complement). Result, positive or pseudopositive?

(3) Using Fairley's antigen with a routine Wassermann technique (U. S. Public Health Service technique), complete inhibition of hæmolysis with the patient's serum was obtained. Result, positive or pseudopositive?

Fairley's interpretation of the above complement fixation tests was that he would definitely regard as negative any serum (1/5) which in the presence of antigen (1/40) fails to completely inhibit hæmolysis with 3 M. H. D.'s of complement. When complement is decreased or serum used in more concentrated quantities, or cholesterol is added to reinforce the cercarial extract, pseudopositive reactions are liable to occur. The test is quite sensitive enough without these measures being employed. Evidently a 1 to 40 concentration of antigen is too strong for routine Wassermann technique, and if this were to be employed on future occasions, the antigen would need to be restandardized in terms of the particular system used in the test. Standardization should be made against normal, syphilitic, and *Schistosoma* serum.

Intradermal test.—This test likewise proved negative, but in view of its recent development as an aid in the diagnosis of schistosomiasis it is discussed in detail. Fairley and Williams, taking into consideration that many observers regard the incidence of urticaria and allied clinical manifestations in such helminthic diseases as hydatid cyst, filariasis, trichinosis, and schistosomiasis as essentially allergic in origin, devised an intradermal skin test for schistosomiasis. The antigen is made from the dried powdered livers of snails, *Planorbis exustus*, infected with *bilharzia cercariæ*, *Schisto-*

soma spindalis. The reaction is characterized by the rapid appearance of a large white wheal 2 to 3 centimeters in diameter with pseudopodia-like outrunners and a surrounding zone of erythema. Delayed reactions are manifested by erythema, hotness of the skin, and puffy swelling of the deeper tissues occurring 3 to 24 hours after the initial injection. The test is exclusively of diagnostic value and does not afford any index to the effects of drug treatment. Reactions were given by two patients treated for bilharziasis who were regarded as cured both on serological and clinical grounds.

Through the courtesy of Dr. Fairley we obtained a saline extract of dried cercarial infected snail livers and injected 0.25 c. c. of this extract intradermally into the forearm of the patient and three laboratory assistants. The same amount of plain salt solution was injected into the skin of the opposite forearm as a control.

The patient showed a maximum erythema 4 by 8 cm. after a period of 20 minutes. The original wheal did not increase in size or show pseudopodia. There was no delayed reaction and all that remained of the test area was a slightly yellowish pigmentation.

Two of the men used as controls were absolutely negative. The third control shows a maximum erythema of 4 by 4.5 cm. after a period of 20 minutes. The wheal did not increase in size nor show pseudopodia. There was no evidence of a delayed reaction during the following 24 to 48 hours. The saline controls on all the men were negative.

Fairley's interpretation was that the intradermal test was negative, stating that it is the wheal that is of importance. Furthermore it must be of definite dimensions. Erythema per se possesses no diagnostic significance in the immediate response. It is observed not uncommonly in controls.

Napier's aldehyde or formol-gel test was negative. The test may be carried out by adding two drops of commercial formalin to 1 c. c. of clear serum in a small test tube. A whitish opacity occurs at once and in about 30 minutes a stiff whitish jelly, like hard-boiled white of eggs, is formed if the serum is positive. Faust and Meleney found the test positive in Japanese schistosomiasis and remark that it is interesting that the two diseases, kala-azar and schistosomiasis, which respond most favorably to tartar emetic give this reaction.

Precipitin tests suggested by Miyaji and Imai, and Taliaferro, Hoffman, and Cook were not performed as the antigen necessary to carry them out was not available at the time the case was under observation.

All other laboratory tests performed, including the Kahn test, sedimentation test, urinalysis, etc., were negative.

As a part of the study of the case, stained sections of the appendix with a history of the case were forwarded to H. E. Meleney, Vander-

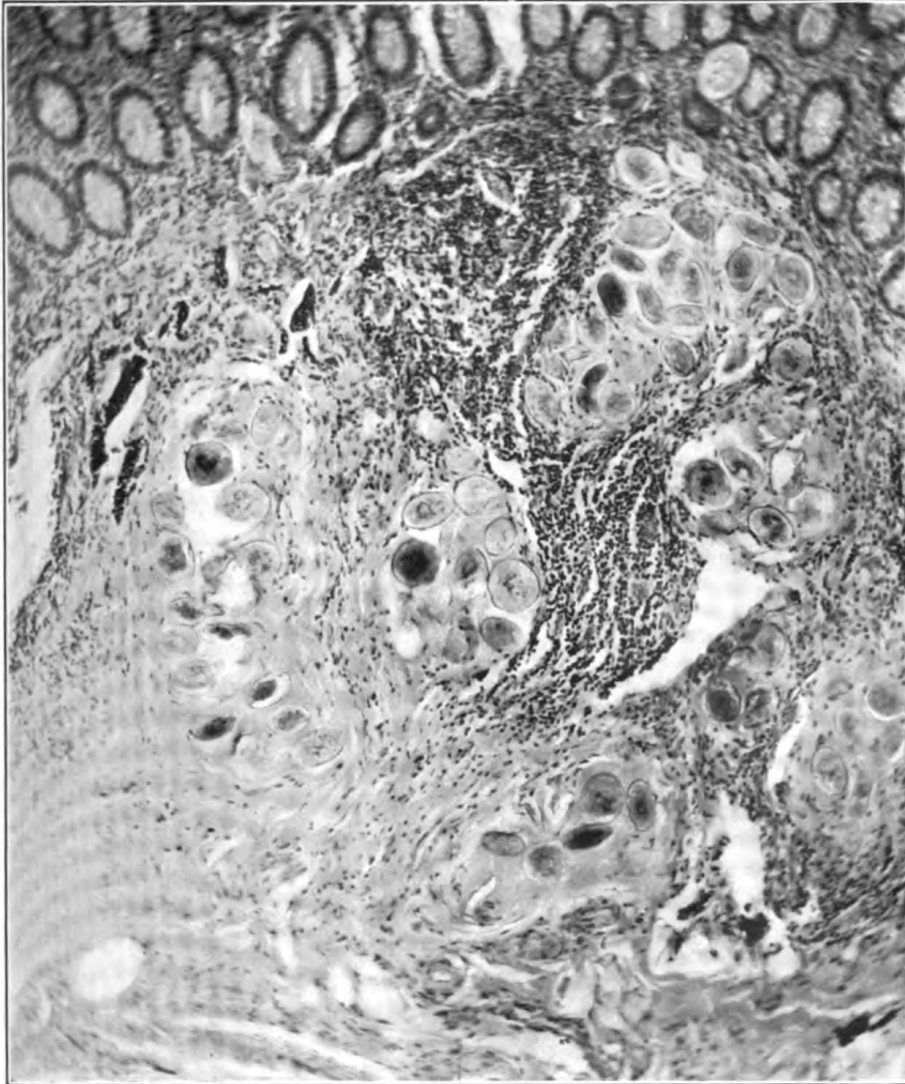
bilt University, Nashville, Tenn., for his opinion and advice. His very instructive comments are quoted verbatim:

I can say from the sections that there is no doubt about the diagnosis of the *Schistosoma japonicum* in this case. The question as to whether the worms are still alive is a more difficult one to answer. The points in favor of the continued activity of the worms are: (1) The eosinophilia of 10 to 14 per cent. (2) The fact that some of the eggs still show the cells of the miracidia inside the eggs in stainable condition. (3) The fact that in the lumen of the appendix there is brownish granular material which seems to be the product of blood and there are crevices leading down through the epithelium into the stroma of the mucosa similar to the appearances which we found in our dogs with active infection. (See monograph on Schistosomiasis by Faust and Meleney, Plate 25.)

The points against the worms still being active are: (1) The fact that there is no abscess formation around any of the eggs. This abscess formation occurs as long as the miracidia within the eggs are able to secrete toxic substances which permeate the surrounding tissues. As their glandular secretion is used up this no longer occurs, but how long this can continue I do not know. There are many eosinophiles in the tissue about some of the eggs and relatively little tendency toward the formation of scar tissue which occurs in very old cases. (2) The fact that no eggs or miracidia have been recovered from the stools. Sections taken from other parts of the appendix or a knowledge of the gross conditions of the mucous surface of the appendix might give more information as to the activity of the process. A knowledge of the clinical findings, both as to the frequency and form of the stools, the symptoms from which the patient suffers, whether there are periodic attacks of pain, or any mucus or blood in the stool, and whether adhesions or points of inflammation on the peritoneum were found at operation would help determine this point. As to the possible span of life of the worms, I believe that it is possible for them to exist for nine years. There is on record a case in which eggs were found in the stool 14 years after patient left the endemic region. My judgment as to the treatment of this case with tartar emetic would be based upon the finding of eggs and miracidia in the stool and the clinical symptoms. If the patient has periods of loose stools or any blood or mucus or if he has ulcers in the rectum or colon on proctoscopic examination, or if eggs or miracidia are found in the stools, I would treat him, otherwise I think it is hardly worth while. Abdominal pain might be due merely to adhesions or to thickening of the colon producing difficulty in the progress of the fecal material through it and these are merely evidence of healed scars.

NOTE.—At the time Doctor Meleney was consulted no eggs had been recovered from the stools.

In regard to the longevity of the *Schistosoma* in the human body, Christopherson states that during the South African war many British soldiers contracted bilharzia disease. In 1920, 18 years after, many of the survivors, who had not been out of England and so could not have been reinfected, were passing live ova in the urine; in other words, some of the worms which the men had acquired in South Africa in 1902 were alive in 1920. The potential longevity of the bilharzia worm must therefore be 18 years. It is, in point of fact, longer.



MICROPHOTOGRAPH OF A STAINED TISSUE SECTION OF THE APPENDIX SHOWING THE EGGS OF SHISTOSOMA JAPONICUM IN THE SUBMUCOSA. $\times 145$. (ARMY MEDICAL MUSEUM PHOTO NO. 47533)

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He also cites a case of a well-known zoologist and doctor of medicine who continued to pass live eggs 28 years after infection. Continuing with the general question of longevity of *Schistosoma*, he claims there may be many strains of worms in the same human host, each strain having its own potential longevity. Some of the worms, no doubt, die each year, it being common experience, if no complications intervene, that symptoms improve with time. The weaker strains die first, and those with higher potential longevity live longer—it may be over 20 years, while a few live longer still.

The case under discussion was undoubtedly a light infection, to start with, and without treatment had made a clinical recovery. Nevertheless, as the examination of the appendix showed, a certain amount of pathology is present in the intestinal tract. The eggs recovered in the stools were apparently not viable. Whether or not a certain number of live adult schistosomes continue to exist, we are unable to determine, and for this reason and the fact that intestinal pathology was demonstrated, treatment was considered advisable.

SUMMARY

1. The disease, Japanese schistosomiasis, was contracted eight years ago at Ichang, China.

2. There was no history of symptoms of the first stage, i. e., urticaria, fever, etc.

3. The first symptom was noticed six years after infection, namely, discomfort in the lower right abdomen, which was later diagnosed chronic appendicitis.

4. The diagnosis was established in this particular case by a pathological examination of the appendix eight years after contracting the infection. The appendix showed eggs of the *S. japonicum* in the submucosa. Incidentally, this shows the importance of a routine pathological examination of all appendices necessitating removal.

5. The complement fixation, intradermal, and blood serum aldehyde tests were negative.

6. The only definite evidence of the condition at this time was the presence of a few eggs in the stools. Attempts to develop the miracidial stage from the eggs were unsuccessful. While an eosinophilia was present it might be partly or wholly due to a coexistent *Trichuris trichiura* infection.

7. Treatment with tartar emetic administered intravenously was recommended on account of the presence of eggs in the stool and the fact that it has been shown that certain human schistosomes may have a longevity of 18 years or longer.

8. The effect of treatment is to be determined by periodic examination of the stools and possibly the influence on the eosinophilia.

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RHINOLITH

By F. E. Locy, Lieutenant Commander, Medical Corps, United States Navy

Calcareous deposits in the nose are not commonly found. While calculi probably begin their formation in the nose as frequently as elsewhere in the body, the large anterior and posterior openings into the nasal cavity provide an exit for the stones before they attain any considerable size. This case is reported on account of the large size of the stone and its clear definition in the X-ray negative.

CASE REPORT

R. A. M., a Veterans' Bureau patient, was admitted to the United States Naval-Hospital at League Island, Pa., on September 24, 1928, with a diagnosis of deviation of the nasal septum and chronic tonsillitis. He complained chiefly of a nasal discharge and a foul breath. For the past two years he had been troubled with this condition, which was becoming more marked of late. Difficulty in breathing through the nose, and afternoon headaches had been present with remissions during this time. The patient had averaged two attacks of acute sore throat each winter for past 10 years. He had a gonococcus infection of the urethra in 1920 and gave an indefinite history of syphilis occurring at this time.

Physical examination showed a well-nourished and fairly well developed white male, 28 years of age. General physical examination was negative except for the nose and throat condition. The tonsils showed the usual signs of chronic infection. Nasal examination showed a narrowing of the air passages on the left side, due to a moderate deviation of the nasal septum. Pus was present on the floor of the right side of the nose. The odor of the patient's breath was particularly offensive. The Wassermann test was reported 1 plus and the Kahn reaction 2 plus. Röntgenological report on the sinuses was as follows: X-ray examination of the nasal accessory sinuses shows no abnormal shadows. There is a circular area of increased density in the floor of the right nares, apparently attached to the inferior turbinate, which shows irregular trabeculation and resembles an osteoma.

The tonsils were removed on September 28; recovery was uneventful. Two days later the mucous membranes of the right side of the nose were shrunk and anesthetized with cocaine and adrenalin. The nose was then irrigated with warm normal saline solution. On the floor of the nose about half way back there appeared a dark foreign body, which was partly beneath the inferior turbinate.

The writer attempted to remove this object intact but failed on account of its size and friability. It was finally broken up with a heavy nasal forceps and removed. The pieces were grayish black in color and of a firm, porous consistency. They crumbled easily under slight pressure to pumicelike particles. The two largest pieces average 0.75 c. m. in diameter. No core was noted after careful examination. Laboratory examination showed the predominating substance to be calcium phosphate with an admixture of blood and carbon (coal dust?). Recovery was uneventful and the patient was discharged on October 5. His foul breath had disappeared.

THE ERADICATION OF BEDBUGS

By E. A. SHARP, Lieutenant Commander, Medical Corps, United States Navy

The eradication of bedbugs on board ship when thorough fumigation is impracticable may tax the ingenuity of the medical department to the utmost.

The difficulties encountered in radical and temporary measures for combating vermin arise from several causes:

(1) Compartments equipped with standee metal bunks on some types of ships can not be made air-tight without great difficulty.

(2) To fumigate sleeping compartments by gas requires skilled workers and special apparatus.

(3) The ship must be abandoned during gas fumigation. -

(4) "Flaming" metal parts is valueless for the reason that bedbugs infest with equal frequency cloth, metal, and wood.

(5) Sterilization of mattresses and mattress covers, blankets, etc., is practicable only by means of special equipment.

(6) Spraying with insecticides does not penetrate mattress folds nor reach the under surfaces of tufts and close joints of metal bunks.

(7) Insecticides destroy vermin readily, but eggs probably require longer exposure and stronger reagents.

(8) Operating schedules of ships frequently prevent fumigation in ports where it is available.

These obstacles and a ship with one to two hundred luxuriantly vermin-infested bunks may well be considered a naval medical problem. In a situation where obstacle No. 8 in the foregoing paragraph obtained, the following procedure was adopted:

(1) All hands were mustered by divisions at 5 a. m. reveille with division officers present.

(2) All bedding was inspected. Dirty, torn, infested mattresses were expended and replaced.

(3) All mattress covers were sent to the laundry.

(4) All bunks, including chains, shackles, and shackle bolts, were carried to the weather deck and immersed in a vat containing cresol 25 parts and kerosene 75 parts. (The "vat" employed was the ship's punt, as it was the only available container large enough for the purpose.)

(5) Five minutes exposure in the cresol-kerosene mixture was augmented by scrubbing with brooms and brushes.

(6) When the bunks were removed from the insecticide they were piled on deck and washed thoroughly by a high-pressure stream of water and left to air-dry.

(7) A machinist's mate with a steam lance made on board steamed the bulkheads, stanchions, overhead, lockers, deck, beams, joints, rivet heads, etc., of the sleeping compartments. The steam was obtained from a line carrying 60 pounds pressure.

(8) The mattresses retained were sterilized in an autoclave at the navy-yard dispensary.

(9) With all hands working the undertaking was completed at 5.30 that afternoon; all bunks and bedding were in their proper places and in use that night.

COMMENT

In using cresol and kerosene it is necessary to supervise untrained helpers for obvious reasons. They were provided with tallow for

coating their hands and arms, which offers ample protection. The entire operation was supervised by the medical officer and Hospital Corps men, but the willing cooperation of all officers and men facilitated the work.

That the procedure was successful is attested by the fact that in rigid inspection twice each week for the next nine months, during which time the ship went to Australia, bedbugs were not found. The crew, by executive order, was admonished to report immediately if bedbugs were found. Two years later a trustworthy member of the crew furnished the information that bedbugs had not been found on the ship during the 18 months he was on board following this attempt at eradication.

This method of combating vermin offers nothing original or unique. It is given in outline to aid medical officers who may be placed in circumstances necessitating the adoption of a similar procedure.

A SIMPLE AND EASILY MADE TRACTION SPLINT FOR FRACTURES OF HUMERUS

By L. H. WILLIAMS, Lieutenant Commander, Medical Corps, United States Navy

Necessity compelled the making of a traction splint for fractures of the proximal third of the humerus. The splint pictured resembles in general outline a Percharmont traction splint of which it is a modification. Since the simplified modification resulted in much usefulness in our hands at the Justinien Hospital, Cape Haitien, Haiti, it may be of aid to others where more elaborate apparatus is not available.

The splint pictured here is constructed of $\frac{1}{4}$ -inch iron wire. Approximately 7 feet are required for making a splint for adults. The curved portion should be made large enough to fit properly after padding.

No brazing or extensive metal work is required, as in the construction of a Percharmont splint. One needs only the wire, a vise, a file, and hammer. The ends may be secured by wire or adhesive tape.

The part to be placed in the axilla is well padded to protect the soft parts when traction is applied to the upper arm. Traction is maintained by adhesive straps and a Spanish windlass. The lower arm is held securely by a bandage wound around the projecting part of the splint. A handhold may be secured to this part and grasped for exercise of the lower arm.

A pad of the required thickness may be inserted between the upper arm and splint, or axilla and splint, and securely held in

place by a bandage when it is necessary to exert steady pressure on the lower fragment to bring it in line with the upper.

The splint here pictured has been used with excellent anatomical and functional results on 10 fractures of the proximal third of the humerus.

COMPLETE UNILATERAL DUPLICATION OF URETER AND PELVIS

By F. R. MOORE, Lieutenant (Junior Grade), Medical Corps, United States Navy

Duplication of the ureters, i. e., double or supernumerary ureter is one of the most frequent anomalies of the urogenital system.

The duplication may be complete or incomplete, and bilateral or unilateral. The frequency of both complete and incomplete duplication of the ureter has been estimated from autopsy findings as follows: Wagner (1), 3 per cent; Poirier (2), 4 per cent; Bostroem (3), 3 per cent. In a series of 144 cases of duplication of the ureter reported by Braasch and Scholl (4), 44 cases, or 30 per cent, were complete and 100 cases, or 70 per cent, incomplete; of the former the condition was bilateral in 8 cases, or 18 per cent, and unilateral in 36, or 82 per cent.

Harpster, Brown, and Delcher (5) reported a series of 382 cases of complete and incomplete duplication of the ureter. The complete doubling occurred in 221, 58.1 per cent; it was bilateral in 40 cases, 18 per cent; and unilateral in 181 cases, 82 per cent. Of the latter, 10 cases were of the free supernumerary kidney, 5.5 per cent, and 171, 94.5 per cent, of the fused or double kidney type. In 161 cases of incomplete doubling the condition was bilateral in 28, 17.4 per cent; unilateral in 133, 82.6 per cent; and of the latter there were 9 cases of free supernumerary kidney. The latter report is probably nearer the correct percentage, because of the larger number of cases reported.

The embryological explanation for the complete duplication of the ureter is that there is an early splitting of the ureteral bud. This explains the complete and incomplete duplication very clearly. Another explanation is that it is the result of the development of two separate anlagen, one above the other, with a fusion of the nephrogenic portions, explaining the double or fused kidney; or their continued separation, explaining the free, supernumerary kidney. The latter theory does not explain the incomplete duplication; therefore the first explanation would seem to be the more reasonable.

Anomalies of the kidney and ureter are more susceptible to disease processes than normal kidney and ureter. Braasch and Scholl (4) found 54, 37.5 per cent, out of 144 cases presenting some pathology.



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The following case report is of interest in this connection:

M. J. J. Admitted on 3-22-28 with an acute Otitis Media; temperature, 99.2° F. Left eardrum moderately inflamed and bulging. Paracentesis performed on 3-22-28, good drainage established. By 3-26-28 marked tenderness had developed over the left mastoid area. Urine negative for pus cells but contained a slight trace of albumin and a few granular casts. On 3-28-28, mastoidectomy performed under ether anesthesia; the findings were those of a typical acute mastoid. The postoperative temperature rose to 100° F., and by the fifth day the temperature was normal.

On 4-7-28, 10 days following mastoidectomy, the temperature suddenly rose to 104° F.; patient's only complaint was headache. Mastoid wound was clean and healing. The temperature curve became septic (99°-104° F.). Urine on 4-10-28; albumin, 3 plus; numerous W. B. C.; blood positive and many blood casts. The patient now complained of dull pain over the right kidney and moderate frequency of urination. He was resting very comfortably after three days on forced liquids and large doses of urotropin with acid sodium phosphate.

Cystoscopy was performed on 4-14-28. The temperature was still septic, 100° F.-104° F. Cystoscopy revealed residue 50 c. c. of cloudy turbid urine, capacity 225 c. c. Moderate injection of trigone particularly about the right ureteral orifice; bladder wall normal except for slight infection. The ureteral orifices were normal in size and position. No. 6 catheters were passed easily up the right and left ureter. As the catheter was started up the right ureter a small slit in the mucosa was noted to spurt urine at regular intervals. This was located 1 c. m. medially and 1 c. m. caudally to the right ureteral orifice. A No. 6 catheter was passed into the slit and on up 33 c. m., where resistance was met. Specimens from the catheters in the supernumerary and left ureters were clear and sparkling. A specimen from the right ureter was cloudy and blood tinged. The routine urine examination of this latter specimen showed: Reaction, slightly acid; albumin, 3 plus; loaded with W. B. C. and R. B. C.; also numerous blood casts. Pyelogram revealed a complete unilateral duplication of the ureter and pelvis on the right side; also an enlarged fused kidney. Smears and cultures were negative on the specimens collected from the left and supernumerary ureters, but from the right the smears revealed numerous staphylococci, and on culture these proved to be staphylococcus aureus.

On 4-18-28 the temperature curve was the same. A No. 6 catheter passed up the right ureter easily, and the pelvis was washed with 1 per cent silver nitrate. Bladder conditions unchanged. Urine unchanged. Urotropin and acid sodium phosphate discontinued and sodium bicarbonate grs. 20 t. i. d. started.

4-20-28: Temperature, 99°-102° F. Patient resting easier.

4-22-28: Temperature, 99°-102° F. Pelvic lavage repeated.

4-23-28: Temperature, 99°-102° F. Mercurochrome, 10 c. c., 1 per cent intravenously. (No reaction noted.)

4-24-28: Temperature normal all day.

4-28-28: Temperature normal. Cystoscopy revealed; bladder wall normal, trigone slightly infected, especially around the right ureteral orifice. Specimen from right ureter slightly cloudy; albumin, 1 plus; moderate W. B. C.; no casts, no R. B. C.

5-1-28: Urine, albumin slight trace; 5-10 W. B. C. per high power field; few R. B. C.; a few granular casts. No complaints. Mercurochrome, 10 c. c., 1 per cent intravenously.

5-3-28: Pyelogram of left side reveals normal ureter and pelvis. Mercurochrome, 1 per cent; 10 c. c. intravenously.

5-10-28: Kidney function, phenolsulphonephthalein; appearance time, left 3 minutes, right 3 minutes; supernumerary $3\frac{1}{4}$ minutes. Percentages at the end of 15 minutes: Left, 38 per cent; right, 22 per cent; supernumerary, 20 per cent. A catheter was passed into the right ureter as far as the kidney. A plain X ray and pyelogram revealed the catheter entering the lower of the two pelves, proving that the ureter from the normally placed ureteral orifice entered the lower pelvis.

From this time on the patient received weekly lavages of the lower pelvis with 1 per cent silver nitrate. The reaction of the urine was also changed from acid to alkaline and back to acid during this period.

On 6-18-28 he was discharged to duty well.

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THE REMOVAL OF TATTOO MARKS

By J. H. KORB, Lieutenant (Junior Grade), Medical Corps, United States Navy

Many men possess one or more tattoo marks. Often the sentiment which inspired their acquirement disappears and they become a source of embarrassment. This leads to a desire for having these marks removed, and the medical officer is often questioned as to the various methods of removal and the advantages and disadvantages of each. It has often been stated that tattoo marks once placed on the skin are permanent, and any attempt of removal causes severe scarring and probable keloid formation. Statements found in literature and text-books give the impression that all methods for their removal now in use are very unsatisfactory. It was not until Shie (1) published his article that I attempted the removal of tattoo marks. His article was so convincingly and enthusiastically written and the method so clearly outlined that it was decided to use his technique on some of the individuals requesting the removal of these designs.

His method is as follows and is copied almost verbatim:

The area involved is prepared as for a surgical operation. A 50 per cent solution of tannic acid in water is then tattooed into the design, care being taken that the solution is carried well into the corium. The area is painted with the tannic acid, and as the tattooing progresses, an assistant adds fresh tannic acid from time to time with a cotton tampon, so that the tattooing is always done



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through the solution. The skin must be tightly stretched during the operation to minimize the discomfort and to favor penetration of the chemical to the proper depth.

Shie uses a short piece of $\frac{3}{8}$ -inch brass tubing into the slightly flattened end of which are soldered 10 fine needles. In all my work an electric tattooing shading needle was used. I found that it worked most satisfactorily when every other needle was removed. This gives a small space between the needles and favors penetration. The manufacturers of this instrument attach the needles to a steel wire. This bends and does not give the proper penetration. When the needles are attached to a rigid bar much better results are obtained. The solution must be tattooed thoroughly into the whole design, care being taken to tattoo it deeply into the corium along the edges of the mark where the pigment usually lies deepest.

As the operation progresses the design becomes grayish in tint, somewhat hard to the touch, and elevated above the surrounding skin. When the operation is completed the entire design is closely covered with needle marks and the pigment is almost obliterated by the grayish tint and by numerous fine droplets of blood. The excess tannic acid is then removed from the surrounding area by washing with cold water. Sterile petrolatum or collodium is applied to the adjacent skin, a clear margin of about one-fourth inch being left around the edge of the design. This is done to prevent discoloration of the skin during the next stage. A stick of silver nitrate is then rubbed vigorously into the treated area, forming a heavy deposit of silver tannate in the corium. When this step is completed the design itself and the gray discoloration made by the tannic acid are entirely obliterated by the silver tannate. The petrolatum is wiped off and the field is washed with cold water. If there is any doubt as to the thorough penetration of the silver tannate into the corium, it is well to dress this area with some of the tannic acid solution, otherwise a sterile dressing is all that is required.

No anæsthetic is used. The pain does not seem to be severe, and after a small amount of the tannic acid is tattooed into the skin the area becomes anæsthetic. The process is no more painful than the original tattooing. Care must be taken to tattoo the tannic acid at least one-half inch beyond the edge of the design. It was found that on application of the silver nitrate, burning was more severe and lasted for a much longer period whenever the silver nitrate came in contact with skin which had not been tattooed with tannic acid. The burning sensation of the tattooed area impregnated with tannic acid lasts for about five minutes. After this there is some discomfort for about two days. If, however, silver nitrate is applied to an area where tannic acid has not been tattooed, the burning sensation is severe, often lasting 24 to 36 hours.

There is very little induration. The tattooed area in about 12 hours becomes hard and leathery and is not painful to moderate pressure. In 10 or 12 days the edges become free and in about 16 days the tattooed area drops off in a thin piece resembling leather. This carries with it more or less of the design. A thin layer of epithelium slowly forms while the tanned area separates. Often deposits of pigment will be found where the design was deepest. These may be removed by repeating the original process.

This process of removal was used on 28 designs. The first 5 of the series were failures due to insufficient penetration of the tannic acid and silver nitrate into the skin, leaving the deeper pigment of the design. Also these men had considerable pain lasting one or two days due to the tattooing of an insufficient area about the design and silver nitrate coming in contact with the unimpregnated skin.

In this series of 28 to which the outlined treatment was applied there were 8 in which the design was completely removed, 12 that had only small deposits of the pigment scattered where it was deep, and 8 in which only the superficial layer of the designs were removed. In all these there was scarring. The area appeared as if there had been a severe abrasion or superficial burn. They were either pinkish or lighter in color than the surrounding skin. All areas are soft and pliable, and there is no keloid formation.

None of these men were placed on the sick list, and all of them were able to perform their regular duties. In this group there were no infections. Six of the men, curious to see how much of the design had been removed, lifted the tanned area and exposed the surface before epithelization. These showed more scarring than any of the others. None of the men having more than one design asked to have a second one removed, and three asked to have deposits removed that remained after the original treatment. However, men who had a tattoo mark removed stated that they preferred the scar to the design.

In conclusion we may say that any method which causes destruction of the superficial layers of the skin carries with it pigment when sloughed off. The problem is to develop a technique by which the operator is able to judge the depth of this destruction, which gives minimum scarring, a soft pliable scar, and no keloid formation. It has been found that if the skin destroyed is superficial to the hair follicles very little scarring results. To be able to apply this correct amount of destructive agent is difficult. However, with the above-described method comparatively little experience teaches one how deeply the tannic acid must be tattooed, and how much silver nitrate must be applied to various parts of the body to give good results. Even then one is never sure just how deeply the silver tannate penetrates and can never accurately predict results.

Another uncertain factor is the depth to which the pigment was originally placed. Hand tattooed designs are deeper than those done with the electric tattooing apparatus. Whenever one design is covered with another the pigment is deeper. Sometimes pigment is found in the subcutaneous tissue. Obviously this can not be removed by attempting to remain superficial to the hair follicles, and if later removed by repeating the process considerable scarring results. Most satisfactory results are obtained on tattoo marks of less than one year's duration. Old marks are deeper. It has been suggested that the pigment is carried to the deeper structures by the lymph. No after-treatment is indicated. Best results were obtained where the tattooed area was covered with a sterile dressing, no medicinal agent of any kind applied, and the eschar allowed to drop off.

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USE OF TONSILLECTOMY SNARE IN EYE ENUCLEATION

By E. C. EBERT, Lieutenant Commander, Medical Corps, United States Navy

Although the writer is not aware of any previous mention in the literature on this point of technique in eye enucleation, no originality is claimed for his suggestion of its use.

During recent duty at the Haitian General Hospital, where eye enucleation is frequently called for, our attention was brought to the desirability of a technique which would minimize hemorrhage and thus increase the vision of the operative field and general operative facility.

It was found that after incision of the conjunctiva and division of the rectus tendons, the tonsil snare could be easily applied and the operation quickly completed as in the manner of a tonsillectomy. This technique was used in 12 enucleations, hemorrhage being materially reduced as compared to the method of using sharp cutting instruments throughout.

Much of the necessity for packing was thus obviated and sutures were easily placed without the annoyance of obscurity caused by hemorrhage.

SYPHILIS—RECURRENCE OR REINFECTION?

By C. S. STEPHENSON, Lieutenant Commander, Medical Corps, United States Navy, and
J. LOVE, Lieutenant (Junior Grade), Medical Corps, United States Navy

It is the general belief of syphilologists that while a patient has lues he enjoys an immunity to further syphilitic infection. However, when that patient is cured of his disease he is just as liable to con-

tract a new infection as anyone. With this as a basis it is argued that reinfection is a sign of eradication of the first infection. This is of importance in that it shows that the present methods of treating syphilis do cure, and it is reasonable to assume that the majority of cases so cured do not become reinfected.

The relapsing tendency of syphilis is also well known especially as regards the serology, and all modern syphilologists instruct their supposedly cured serologically negative cases to have semiannual blood tests.

As a result of this relapsing tendency we have been prone to regard recurrent chancres, reappearing secondary manifestations, and relapsing serum findings as recurrences rather than reinfections. But it is our opinion that reinfection is more common than is generally believed, especially in the Asiatic Station, where the tropical background and alcoholic foreground coupled with the lack of other forms of amusement and relaxation lead to excessive venery and increased syphilis.

For the therapeutic defense against this we are more alert in discovering leucic infection, and intensive specific treatment is the rule; hence more serological reverses and probable cures with greater chances of reinfection.

In the health records we are able to follow our patients for several years, as the abstracts contain an account of their exposures, manifestations, treatment, and serological progress.

Theoretically the following criteria must be fulfilled before a case can be regarded as a reinfection and not as a recurrence:

1. History of typical chancre after proper interval of exposure with positive dark-field or secondary manifestations with a repeated 4 plus blood test.
2. The disappearance of the lesions and reversal of the blood test under specific therapy.
3. Absence of symptoms and signs with a persistent negative blood after treatment has been stopped, preferably for two years.
4. Development of a new chancre at some different site after proper interval from date of exposure.
5. Finding of positive dark-field or development of secondaries with 4 plus blood test.

From the abstracts of some 60 cases on the U. S. S. *Beaver* we wish to present for consideration the following cases:

CASE 1.—L. P. In 1923, after feeling badly for several weeks, especially complaining of nocturnal headaches, the patient desired a blood test. He admitted frequent coitus, but denied having had a sore. General adenopathy was the only positive physical finding, but two Wassermann tests were 4 plus. Eleven doses of neoarsphenamine and six doses of mercury salicylate were administered, and the blood test was reversed to negative in July, 1924. Thereafter frequent

blood tests were repeatedly negative, including one in July, 1928. During the months of October and November, 1928, this patient cohabited frequently, and on December 19, 1928, a small sore about the size of a pinhead appeared and grew rapidly to a round indurated typical hard chancre. Although dark-field examinations were negative, local treatment was of no avail in curing the sore and a Kahn test on January 7, 1928, was strongly positive. Inguinal adenopathy was marked, but both this and the sore immediately subsided when specific therapy was begun.

CASE 2.—C. J. M. This patient had a negative Kahn in October, 1926, but was exposed in Tsingtao, China, on July 30, 1927. A month later an ulcer appeared on the corona of the penis. Repeated Fontana examinations were negative for *treponema pallida*, but the sore refused to heal. A Kahn reaction was 4 plus. Twenty-four neoarsphenamine injections, and 50 mercury rubs succeeded in bringing about negative Kahns, the last of which was taken August, 1928. On October 1, 1928, after exposure in September patient noticed a sore on his penis. This was oval shaped and indurated and was found positive for *treponema pallida*. There was also inguinal adenopathy of rather marked degree, and on October 25, the Kahn reaction was 4 plus. These lesions disappeared with the advent of specific therapy.

CASE 3.—J. C. L. A small pimple appeared on this patient's penis in December, 1923, after exposure. No spirochetes were found by dark field, but a month later marked inguinal adenopathy, a typical macular rash, and 4 plus Kahn test settled the diagnosis of this infection. Twenty-four neoarsphenamine injections and 10 intramuscular mercury injections brought about a negative Kahn reaction. Two tests in 1923 were also Kahn negative. In August, 1925, patient had another lesion of the penis after proper time interval following exposure. A month later a 3 plus Wassermann was obtained. Specific therapy cured this lesion and reduced the reaction to negative, which has been maintained for the past three years.

CASE 4.—C. A. G. This patient in 1917 was bothered with a patchy alopecia. Investigation revealed a 2 plus Wasserman and healed lesion on penis. This was not thought of great importance, and very little treatment was given. In 1919 the Kahn was 3 plus and the patient was then given specific therapy, which reduced the serology to negative. Several tests from 1919 to 1925 were negative until November, 1925, when the Kahn was 4 plus. The patient had been exposed in August, 1925, and had a primary sore on the penis a month later. Simultaneous with the positive blood test a beginning macular rash was observed. Intensive treatment with arsenicals, mercurials, and iodides have reduced the reaction to negative, and it has remained so for the past three years.

CASE 5.—J. O. D. This patient was exposed July 10, 1926, and two weeks thereafter an indurated ulceration appeared on the penis. This was followed by inguinal and cervical adenopathy, and a Kahn test in August was 4 plus. Twenty-four neoarsphenamine injections and 40 mercury rubs reduced his Kahn to negative and cured his symptoms entirely. His last negative Kahn was taken in February, 1928. In March, 1928, the patient was again exposed and a large indurated ulcer appeared on the prepuce early in April. Repeated Fontana stains were negative for *treponema pallida*, but secondaries appeared in May along with a 4 plus Kahn, which was repeatedly positive.

CASE 6.—L. A. C. This patient while in France was exposed June 28, 1926. A pinhead lesion appeared on the penis a month later. This lesion grew larger and became indurated and a positive dark field was obtained August 3, 1926. Two weeks later a Kahn test was found to be 3 plus. Intensive combined

arsenic and mercury treatment rendered his serum both Kahn and Wassermann negative, including a negative Kahn in December, 1927. On December 19, 1927, a typical hard chancre appeared on the coronal sulcus. This sore was treated by the patient for three weeks without avail before he reported it to the medical officer in January, 1928. There was a history of exposure three weeks before the lesion appeared. This ulcer was deep, punched out, hardened with indurated edges, and discharging a serous fluid. Two large indurated right inguinal glands were felt. The Kahn test was 4 plus on three occasions. Twelve salvarsan injections and six mercury bichloride injections reversed the blood reaction to negative in May and also in September of 1928. In January, 1929, he was again exposed and again an ulcer appeared on his penis which was negative for *treponema pallida* by dark-field examinations. Treatment of this sore was of no avail and inguinal adenopathy developed. A blood test on February 7 was 4 plus, and two checks since have also been strongly positive. His sore began to heal immediately when specific therapy was started.

While these cases as a whole do not absolutely fulfill the criteria mentioned above, it is felt by us that these cases are more satisfactorily explained on the basis of reinfection than recurrence. The last one is especially interesting as it appears to be an example of triple infection. If a positive blood test or a luetic sore appears after intercourse in a patient who has had syphilis before and has been rendered serologically negative by treatment, it appears to us to be more reasonable to consider this a reinfection than a recurrence; and we assume that the modern regimen of treating lues is curative on the basis that an infected patient can not be reinfected.

CONCLUSIONS

1. Reinfection is more common than generally supposed.
2. Accepting reinfection as a sign of cure, the modern regimen of intensive early treatment is curative.

A SYSTEMATIC ARRANGEMENT OF DENTAL INSTRUMENTS

By C. V. RAULT, Lieutenant Commander, Dental Corps, United States Navy

The system herein explained has been devised in an effort to secure a uniform arrangement of instruments in the dental cabinet and to maintain them in an assigned place.

Five wooden trays were constructed for every cabinet, each grooved to hold 34 instruments.

Drawer No. 1, the upper left, contains 34 cavity-preparation instruments. (Table 1.) The remaining 29 cavity-preparation instruments on the supply table are placed in drawer No. 2, the upper right, leaving five vacant grooves to hold any special cavity-preparation instruments the individual operator may possess. (Table 2.)

Tables 1 to 5 list the instruments contained in each drawer. In the first column is the stock number; then follows the instrument

name and number; the last column contains the groove number. These lists are placed in the front of the instrument drawers. (See plate.)

The instruments' names and numbers on these lists have been spaced so as to appear under their respective instruments. Multi-graphed copies are made that they may be changed when soiled. These lists aid the uninitiated dental assistant in learning the names of instruments. They also help the property custodian to discover missing instruments and to prepare requisitions.

A diagonal line is drawn across the instruments' handles; a ring is then cut around the handle of each instrument, with a carborundum stone, to correspond to the diagonal line. (See plate.) This prevents the assistant placing the instruments in an incorrect groove should he not have learned its name.

In the Naval Dental School, where 10 units are in operation, the unit number is stamped with a steel die on each instrument.

Having a uniform arrangement of instruments enables an operator or assistant to work at any unit and know exactly where to find each instrument.

TABLE 1. *Drawer No. 1 (upper left)—Instruments for cavity preparation*

Stock No.	Groove No.
24-025. Chisel, with handle, No. 1.....	1
24-027. Chisel, with handle, No. 3.....	2
24-029. Chisel, with handle, No. 4.....	3
24-031. Chisel, with handle, No. 9.....	4
24-033. Chisel, with handle, No. 10.....	5
24-035. Chisel, with handle, No. 60.....	6
24-037. Chisel, with handle, No. 61.....	7
24-101. Cutting instrument (black) No. 81.....	8
24-103. Cutting instrument (black) No. 82.....	9
24-105. Cutting instrument (black) No. 83.....	10
24-107. Cutting instrument (black) No. 84.....	11
24-109. Cutting instrument (black) No. 85.....	12
24-111. Cutting instrument (black) No. 86.....	13
24-081. Cutting instrument (black) No. 61.....	14
24-083. Cutting instrument (black) No. 62.....	15
24-085. Cutting instrument (black) No. 63.....	16
24-087. Cutting instrument (black) No. 64.....	17
24-089. Cutting instrument (black) No. 65.....	18
24-091. Cutting instrument (black) No. 66.....	19
24-117. Cutting instrument (black) No. 89.....	20
24-119. Cutting instrument (black) No. 92.....	21
24-149. Excavator, with handle, No. 99.....	22
24-159. Excavator, with handle, No. 115.....	23
24-161. Excavator, with handle, No. 116.....	24
24-155. Excavator, with handle, No. 113.....	25
24-157. Excavator, with handle, No. 114.....	26
24-151. Excavator, with handle, No. 111.....	27

Stock No.	Groove No.
24-153. Excavator, with handle, No. 112.....	28
24-183. Excavator, Darby-Perry, No. 21.....	29
24-185. Excavator, Darby-Perry, No. 22.....	30
24-175. Excavator, Darby-Perry, No. 15.....	31
24-177. Excavator, Darby-Perry, No. 16.....	32
24-179. Excavator, Darby-Perry, No. 17.....	33
24-181. Excavator, Darby-Perry, No. 18.....	34

TABLE 2.—*Drawer No. 2 (upper right)—Additional instruments for cavity preparation*

Stock No.	Groove No.
24-171. Excavator, Darby-Perry, No. 13.....	35
24-173. Excavator, Darby-Perry, No. 14.....	36
24-167. Excavator, Darby-Perry, No. 9.....	37
24-169. Excavator, Darby-Perry, No. 10.....	38
24-163. Excavator, Darby-Perry, No. 5.....	39
24-165. Excavator, Darby-Perry, No. 6.....	40
24-113. Cutting instrument (black) No. 87.....	41
24-115. Cutting instrument (black) No. 88.....	42
24-131. Excavator, with handle, No. 2.....	43
24-133. Excavator, with handle, No. 5.....	44
24-135. Excavator, with handle, No. 18.....	45
24-137. Excavator, with handle, No. 28.....	46
24-139. Excavator, with handle, No. 52.....	47
24-141. Excavator, with handle, No. 59.....	48
24-143. Excavator, with handle, No. 62.....	49
24-145. Excavator, with handle, No. 66.....	50
24-147. Excavator, with handle, No. 67.....	51
24-065. Cutting instrument (black) No. 29.....	52
24-067. Cutting instrument (black) No. 30.....	53
24-069. Cutting instrument (black) No. 49.....	54
24-071. Cutting instrument (black) No. 50.....	55
24-073. Cutting instrument (black) No. 51.....	56
24-075. Cutting instrument (black) No. 52.....	57
24-077. Cutting instrument (black) No. 53.....	58
24-079. Cutting instrument (black) No. 54.....	59
24-097. Cutting instrument (black) No. 79.....	60
24-099. Cutting instrument (black) No. 80.....	61
24-093. Cutting instrument (black) No. 77.....	62
24-095. Cutting instrument (black) No. 78.....	63

TABLE 3. *Under drawer No. 1.—Amalgam and plastic filling instruments*

Stock No.	Groove No.
24-283. Instrument, plastic filling (AR), No. 1.....	69
24-285. Instrument, plastic filling (BL), No. 1.....	70
24-287. Instrument, plastic filling (BL), No. 2.....	71
24-289. Instrument, plastic filling (BL), No. 3.....	72
24-291. Instrument, plastic filling (BL), No. 4.....	73
24-293. Instrument, plastic filling (BL), No. 5.....	74
24-295. Instrument, plastic filling (BL), No. 6.....	75
24-297. Instrument, plastic filling (BL), No. 7.....	76
24-003. Amalgam carver (Frahms 90°), No. 1.....	77
24-005. Amalgam carver (Frahms 90°), No. 2.....	78

Stock No.	Groove No.
24-007. Amalgam carver (Frahms 90°), No. 3.....	79
24-013. Burnisher, with handle, No. 27.....	80
24-015. Burnisher, with handle, No. 29.....	81
24-279. Instrument, plastic filling, No. 40.....	82
24-281. Instrument, plastic filling, No. 40A.....	83
24-199. Finishing instrument, file No. 1.....	84
24-201. Finishing instrument, file No. 2.....	85
24-203. Finishing instrument, file No. 3.....	86
24-205. Finishing instrument, file No. 4.....	87
24-207. Finishing instrument, file No. 5.....	88
24-209. Finishing instrument, file No. 6.....	89
24-211. Finishing instrument, knife No. 7.....	90
24-213. Finishing instrument, knife No. 8.....	91
24-215. Finishing instrument, knife No. 9.....	92
24-275. Instrument, plastic filling (G), No. 2.....	93
24-277. Instrument, plastic filling (G), No. 3.....	94
24-299. Instrument, plastic filling (LA), No. 1.....	95
24-301. Instrument, plastic filling (LA), No. 5.....	96
24-303. Instrument, plastic filling (LA), No. 8.....	97
24-269. Instrument, plastic filling (W), No. 1.....	98
24-271. Instrument, plastic filling (W), No. 2.....	99
24-273. Instrument, plastic filling (W), No. 3.....	100
24-439. Spatula, cement.....	101

TABLE 4.—*Drauer number 4 (under drauer No. 2)—Scalers, root pluggers, etc.*

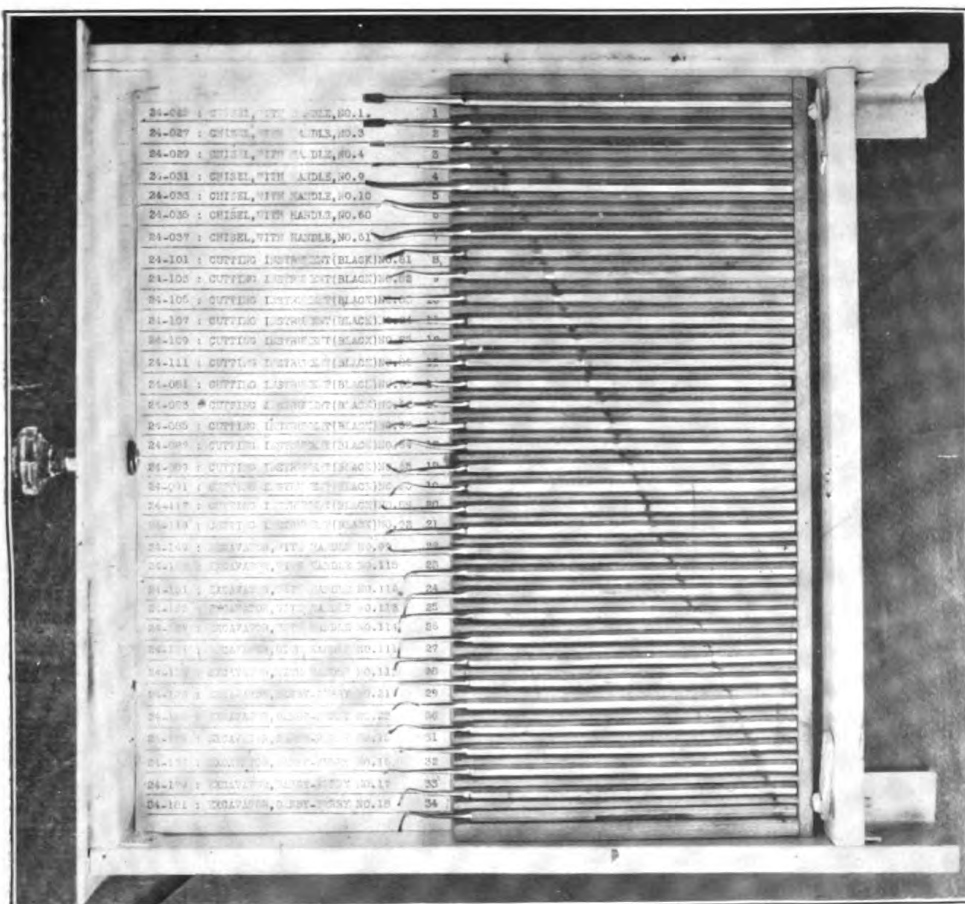
Stock No.	Groove No.
24-305. Instrument, pyorrhea, scaler No. 2.....	103
24-307. Instrument, pyorrhea, scaler No. 3.....	104
24-309. Instrument, pyorrhea, scaler No. 7.....	105
24-311. Instrument pyorrhea, scaler No. 8.....	106
24-313. Instrument pyorrhea, scaler No. 11.....	107
24-315. Instrument, pyorrhea, scaler No. 12.....	108
24-317. Instrument, pyorrhea, file No. 15.....	109
24-319. Instrument, pyorrhea, file No. 16.....	110
24-321. Instrument, pyorrhea, file No. 17.....	111
24-323. Instrument, pyorrhea, file No. 18.....	112
24-325. Instrument, pyorrhea, scaler No. 33.....	113
24-327. Instrument, pyorrhea, scaler No. 34.....	114
24-417. Scaler, with handle, No. 5.....	115
24-419. Scaler, with handle, No. 21.....	116
24-421. Scaler, with handle, No. 22.....	117
24-423. Scaler, with handle, No. 31.....	118
24-425. Scaler, with handle No. 32.....	119
24-427. Scaler, with handle, No. 35.....	120
24-429. Scaler, with handle, No. 36.....	121
24-431. Scaler, with handle, No. 60.....	122
24-351. Plugger, root canal (K), No. 1.....	123
24-353. Plugger, root canal (K), No. 2.....	124
24-355. Plugger, root canal (K), No. 3.....	125
24-357. Plugger, root canal (K), No. 4.....	126
24-359. Plugger, root canal (K), No. 5.....	127
24-361. Plugger, root canal (K), No. 6.....	128

Stock No.	Groove No.
24-363. Plugger, root canal (K), No. 7.....	129
24-365. Plugger, root canal (K), No. 8.....	130
24-367. Plugger, root canal (K), No. 9.....	131
24-369. Plugger, root canal (K), No. 10.....	132
24-371. Plugger, root canal (K), No. 11.....	133
24-373. Plugger, root canal (K), No. 12.....	134
24-063. Cutter, ligature.....	135
24-375. Porte polisher, hand.....	136

TABLE 5. *Drauer No. 5 (under drauer No. 3).—Examination instruments and college pliers*

Silicate cement instruments are placed here to prevent confusing them with oxyphosphate instruments.

Stock No.	Groove No.
23-257. Mirror, mouth, with handle.....	137
23-259. Mirror, mouth, with handle.....	138
23-261. Mirror, mouth, with handle.....	139
24-187. Explorer, with handle, No. 6.....	140
24-189. Explorer, with handle, No. 11.....	141
24-191. Explorer, with handle, No. 12.....	142
24-193. Explorer, with handle, No. 13.....	143
24-195. Explorer, with handle, No. 14.....	144
24-197. Explorer, with handle, No. 17.....	145
24-381. Probe, nerve (flexible), No. 1.....	146
24-383. Probe, nerve (flexible), No. 2.....	147
24-385. Probe, nerve (flexible), No. 3.....	148
24-267. Instrument, silicate cement, No. 1.....	149
24-441. Spatula, silicate cement, No. 1.....	150



DRAWER NO. 1 SHOWING INSTRUMENT LIST IN PLACE AND DIAGONAL LINE FORMED BY CUTTING RING ON INSTRUMENTS' HANDLES AT DIFFERENT HEIGHTS. (RAULT)

NAVAL RESERVE

NEW APPOINTMENTS

Name	Rank and class	Date appointed
Allman, Charlie Hugh.....	Lieutenant, MC-V(G).....	Apr. 2, 1929
Bonar, Martin L.....	Lieutenant commander, MC-V(S).....	Feb. 14, 1929
Brown, Marton Earle.....	Lieutenant commander, MC-V(S).....	Sept. 13, 1928
Creswell, Samuel M.....	Lieutenant (junior grade), MC-V(G).....	Feb. 20, 1929
Davenport, Robert Gerald.....	Lieutenant commander, MC-V(S).....	Mar. 13, 1929
Day, Kenneth Knowlton.....	Lieutenant (junior grade), MC-V(G).....	May 14, 1929
Fenton, Clement Coleman.....	Lieutenant, MC-V(S).....	Apr. 15, 1929
Finklea, Orion Tiberton.....	Lieutenant, MC-V(S).....	Apr. 3, 1929
Hobson, Samuel.....	Lieutenant, MC-V(S).....	Sept. 26, 1928
Hume, John Raymond.....	Lieutenant commander, MC-V(S).....	Sept. 28, 1928
Lawson, Edwin Hugh.....	Lieutenant (junior grade) MC-V(S).....	Nov. 14, 1928
Levis, William R.....	Lieutenant commander, MC-V(G).....	Apr. 20, 1929
Linde, Frederick G.....	Lieutenant commander, MC-V(S).....	Mar. 15, 1929
Miller, Wade Hampton.....	Lieutenant commander, MC-V(S).....	Feb. 1, 1929
Morris, Laird M.....	Lieutenant commander, MC-V(S).....	Mar. 5, 1929
Mundt, Raymond.....	Lieutenant (junior grade) MC-V(G).....	May 15, 1929
Nadler, Walter Herman.....	Lieutenant commander, MC-V(S).....	May 17, 1929
Player, Lionel Paget.....	Lieutenant commander, MC-V(S).....	Apr. 27, 1929
Porter, Joseph Irvin.....	Lieutenant, MC-V(G).....	Jan. 22, 1929
Ransome, Coleman B.....	Lieutenant, MC-V(G).....	Mar. 5, 1929
Regan, James Joseph.....	Lieutenant, MC-V(G).....	Apr. 8, 1929
Spenner, Raymond William.....	Lieutenant (junior grade), MC-V(G).....	Feb. 14, 1929
Stone, James Kelly.....	Lieutenant (junior grade), MC-V(S).....	Dec. 10, 1928
Ungar, Louis.....	Lieutenant, MC-V(S).....	Mar. 5, 1929
Wheatley, Frank Edward.....	Lieutenant commander, MC-V(S).....	Jan. 26, 1929

NURSE CORPS

THE PERSONALITY OF THE NURSE¹

By K. C. MELHORN, Captain, Medical Corps, United States Navy

The trained nurse as a factor in life may be regarded from many points of view—philanthropic, social, personal, professional, and domestic. In the few moments available in this important hour of your lives permit me to engage your earnest attention in what will be the keystone of your success or failure—namely, personality.

It has been defined as “the physical make-up a person is born with plus experiences through which one passes.” There is not an individual or organization which, when the time comes to employ the services of anyone, does not demand a good personality of the applicant. A noted psychologist in one of the large institutions of learning, after a survey involving tests of 50,000 individuals in widely diversified occupations, finds that the value of a complete knowledge of the technique of a person's trade or profession is just about 15 per cent if he or she does not possess the personality to apply it properly. The additional 85 per cent represents that elusive quality known as personality and may be secured through the use of several or all of the following 12 keys necessary in varying degrees to the performance of every type of work: Impressiveness, initiative, thoroughness, observation, concentration, constructive imagination, decision, adaptability, leadership, organizing ability, expression, and knowledge. These traits are that part of the personality that can be developed and improved by each individual if due attention is given to the task. It is most important that one should begin to take cognizance of the lack of any of the above-mentioned qualities needed in his or her particular profession and make a concentrated effort to improve such defects.

The Service d'Hygiène of Haiti is about to launch its program of public-health nursing, and it is our hope to employ within the year 10 graduates in that work alone. Special training will be provided in the new health center for Port au Prince, which is being developed rapidly in the large building near the Cathedral, formerly occupied by the Service Hydraulic. As you have probably

¹ Read before the graduating class of the nurses' training school, Haitian General Hospital, Port au Prince, Haiti, April, 1929.

noted, it has been entirely renovated, very prettily parked, and is proving most satisfactory for our purposes. In that building are now located the offices of the public health officer of the district of Port au Prince, medical inspectors of schools, public health nurse, infant welfare and prenatal clinics, museum, and a very nice photographic laboratory.

Within the coming year selected doctors in the various districts of Haiti will be brought to Port au Prince for special training (one to two months) and then returned to their respective districts for development of similar work there. Each district will be provided with a public health nurse trained in this center. With splendid vision and fine loyalty all of the American Red Cross nurses now teaching in this school have volunteered to assist in the program; and I take this opportunity to publicly express to them the sincere thanks and appreciation of a grateful service. Lastly, in this connection, it gives me the greatest pleasure to announce that provision has finally been made whereby under a Haitian Government fellowship a graduate of this school will, within a few weeks, be sent to the United States for a year's special course in public health nursing.

A higher level of public health is one of education from start to finish. It involves not only the education of the person whose health is to be improved but of every one of the professional groups participating, so that each may have a broader, clearer, and more practical view of the whole problem.

The protective functions of a health department may be mentioned as the fortress which the community has built to ward off attacks of disease against which the individual is powerless to protect himself. Medical service is the scout, so to speak, of the medical profession, finding individuals and conditions needing attention, creating a demand for both curative and preventive measures. Public health nursing is the right arm of this endeavor, following through the purpose in order to secure tangible results and frequently holding together activities which otherwise might be in danger of falling apart.

Thus can you see how this work, for those of you who enter it, is going to bring you into the full glare of publicity as never before. By your personality not only you but the whole movement will be judged. Should you fail in your task, think what it will mean to thousands who never before have known the presence of the trained nurse.

In the words of the immortal Osler:

There is no higher mission in this life than nursing God's poor. In so doing a woman may not reach the ideals of her soul; she may fall far short of the ideals of her head, but she will go far to satiate those longings of the heart from which no woman can escape. . . .

On the stepping-stones of our dead selves we rise to higher things, and in the inner life the serene heights are reached only when we die unto those selfish habits and feelings which absorb so much of our lives. To each one of us at some time . . . has come the blessed impulse to break away from all such ties and follow cherished ideals. Too often it is but a flash of youth, which darkens down with the growing years. Though the dream may never be realized, the impulse will not have been wholly in vain if it enables us to look with sympathy upon the more successful efforts of others. In institutions the corroding effect of routine can be withstood only by maintaining higher ideals of work; but these become the sounding brass and tinkling cymbals without corresponding sound practice. In some of us the ceaseless panorama of suffering tends to dull that fine edge of sympathy with which we started. A great corporation can not have a very fervent charity; the very conditions of its existence limit the exercise. Against this benumbing influence we physicians and nurses, the immediate agents of the trust, have but one enduring corrective—the practice toward patients of the golden rule of humanity as announced by Confucius: "What you do not like when done to yourself, do not do to others," so familiar to us in its positive form as the great Christian counsel of perfection.

In the name of the national public health service, I wish you every success in the field of our mutual endeavor.

RESIGNATION FROM THE NURSE CORPS

It is well occasionally for everyone to check up on himself and his work and take time to consider his blessings along with his disappointments. Those who are young in the service know little of the pioneer work which has brought about present standards for the Navy Nurse Corps, and they often take for granted the delightful conditions that now exist for them without realizing that there are those who have given much time, thought, and labor to accomplish these results.

Some grow restless in the service and often become critical, and decide that they will resign to take a position in civilian life. Unless they resign to be married, a majority of these ask for reinstatement after various periods of time, but unfortunately a reappointment is not always recommended, either for professional or physical reasons, and too late they wonder why they ever resigned.

A short time ago a letter was written to five nurses who had been reappointed to the Navy Nurse Corps, asking that they give their reasons for resigning and just why they decided to return to the service. The low salary is sometimes the cause for resigning if the nurse is in her first pay period, but some of these nurses were in the second pay period, receiving \$90 a month. The hope of a new pay bill giving more pay induced some to seek reappointment, and in some instances the financial burden at home had been lifted. Excerpts from some of these letters follow:

I have been asked by many nurses, both in the service and out in private life, why I resigned from the Navy Nurse Corps after the signing of the armistice.

stice, and why, after several years at home, I asked to be reinstated. I might answer this in many ways, but my principal reason for resigning was that I wanted to be a private duty nurse again. Our salary in the service was low and many of us felt that we could add much more to our savings on the outside. After more than a year of private duty nursing, I entered the Veterans' Bureau service. I enjoyed my four years' duty in this service very much. I kept in touch with many of my friends who had remained in the Navy, and knowing how comfortable the nurses' living conditions were, their regular hours of duty, and opportunities for travel, I wanted very much to be back in the naval service again. My present service has been entirely on the west coast. This fall I will have completed two years of duty and traveled as far south as Panama and north as far as Puget Sound, stopping in all of the large coast cities many weeks at a time.

Because of these pleasant changes and shorter hours of duty, nurses in the Navy do not always feel the need of their annual 30 days' leave. Many nurses accumulate their leave for a special trip, or visit home if they are stationed some distance away. Then, too, change of stations, especially tropical duty, enables one to enjoy an ocean voyage, which is a vacation in itself. My only regret about having left the service is that I did not realize at the time the real advantages of continuous service.

Another writes:

I could not keep up my home responsibility on the money received. Then, too, I was not quite sure that I wanted to stay in the service. At my first station there was a strong current of unrest and a tense feeling of being watched and suspected. It is instinctive with me to be open and above board and I found it most annoying. The criticisms I had on duty were always just and constructive and pleasantly given, but I felt that I should be trusted off duty as well as on duty. The financial difficulties were too pressing for me to overlook that part.

Circumstances at home readjusted much more quickly than I had thought possible and I began to miss the service. I had never gained much joy from sitting beside a telephone on a packed suitcase, and gained less after the steady and regular hours in the service. The type of work in the Navy is more to my liking. With the hours arranged as they are a nurse knows fairly accurately what her leisure is to be and she has opportunity to develop outside interests. The disagreeable points, I decided, were to be found in any institutional position and were usually clashes in personalities. In the service we are always comfortably quartered and well fed, which can not always be said of civilian hospitals.

That was my trend of thought in making my decision to return. I still find the money in the first pay period far from adequate and frequently wonder how I am going to carry on.

From another:

My leaving the Navy Nurse Corps was really for the purpose of comparing the advantages of nursing in civilian life and nursing in the service. The pay of \$90 seemed very small in comparison with the pay received by the day for nursing as a civilian. However, I found after several years' trial that \$90 received regularly, with the 30 days' annual leave, amounted to more in the long run than taking cases where the pay was greater but work was intermittent. Hours in the Navy are shorter and more regular, so that it is possible to plan ahead for week-ends and short trips. The quarters furnished

are usually very attractive and comfortable, and of course within easy reach of one's work. Hence, no time is lost in long trips to and from work and the question of car fare does not exist. It seems to me that all the advantages are on the side of the service versus civilian nursing.

Another writes:

My reason for returning could be summed up in one conclusive statement—the personal interest which seems to be extended to each in your large group of women. That drew me more than anything else. A person is not so apt to make the same mistake twice, so when she decides in favor of a position once renounced, it must be through a changed viewpoint and with wisdom and understanding gained in other work during the interim. Several years ago I requested and was granted, after a number of years of service, discharge from the Navy Nurse Corps.

My service had been, on the whole, interesting and enjoyable. During the first years the newness of the work kept up my interest; then tropical duty, with a wide scope for initiative in rural and welfare work, proved fascinating. Later a special detail held much interest for a year, during which time, though the work was hard and many trying and disagreeable situations arose, there was the joy of achievement along lines planned by the chief nurse and myself. Having weathered this detail through its preliminary constructive period and gotten it to a point where it had just begun to function smoothly, the request for an additional nurse was answered and a nurse was sent; but to her seniority I had to relinquish all initiative, though I remained on the detail. Because of this my interest waned, my anchor was dragging, and my mind became susceptible to small grievances, fancied or real, but, if fancied, real enough to me at that time. The institutional life at the quarters began to chafe; the day wasn't full enough on duty or off to keep me contented, and a thousand and one petty irritations sprang up, small things which would ordinarily have been shaken off or have been but a challenge to a busy mind. Outside of the Navy was the whole world and lots of work.

The years out of the Navy have been happy ones, very busy ones, full of rich experiences, and have brought with them better powers of discernment and clearer vision. When my last contract expired and several new positions were offered, the desire grew in me for a post where I could establish a feeling of permanency and yet remain contented; so, after very thorough consideration, my decision fell for the Navy Nurse Corps.

My reasoning is entirely along the line of one who would consider executive institutional work only, either hospital or training school, and would not necessarily apply to private duty or public-health work.

The Navy Nurse Corps offers better living conditions than the average institution. One is really "at liberty" when off duty and not liable to emergency calls as in a training school or hospital executive position. The hours of duty permit sufficient time to oneself for recreation or mental development, and one is not too tired after the day's work to enjoy it. The irritations of red tape in the Navy work can not be compared to the difficulties met in trying to put over a program in opposition to or by educating one or sometimes several civilian boards of governors, who are usually nonmedical people.

The change which is necessary to maintain mental balance is realized and automatically occurs in the Navy Nurse Corps, whereas in civilian hospitals success as an executive can be achieved only by long service in the same position, and one can gain no prestige by frequent moves. The courses now offered by the Navy give to those interested an opportunity for post-graduate work,

which can be had on the outside only at the sacrifice of time and salary and at one's own expense. The pay of the Navy Nurse Corps is low, to be sure, but a proposed new pay bill holds out a hope for the future. Even aside from that, the assurance of the best medical attention in illness, sick leave if needed, and at the end of service, retirement, is compensation. Of course, salaries in civilian institutional work are fairly good; but one can not weigh values in terms of money alone. I have simply stated my ideas of the values of the Navy Nurse Corps over civilian institutional work, a summarizing which I would not have done had I not seen the whole situation from a detached angle.

Finally, there is the spirit of "belonging," which, once gained, is never lost in the Navy. There are contacts which never wholly die between Navy nurses, and there is a feeling that the individual exists and counts, all creating an atmosphere to which it is well worth returning.

Again, your attention is invited to the privilege given to all members of the Nurse Corps to contribute to this section of the **NAVAL MEDICAL BULLETIN**. If you have constructive criticism to offer, or if you have helpful suggestions to make, it is your duty as well as your privilege to offer your bit for the good of the whole.

PSYCHOLOGY FOR NURSES¹

REACTIONS

Having the field of psychology open before us, the next step is to decide where to begin study. The introspective psychologists usually start with sensations because their great object is to describe consciousness, and they think of sensations as the chief elements of which consciousness is composed. The behaviorists would prefer to start with reflexes, because they conceive of behavior as composed of these simpler motor reactions.

Without caring to attach ourselves exclusively to either introspectionism or behaviorism, it seems advisable here to take our cue from the behaviorists, because we shall find the facts of motor reaction more widely useful in our further studies than the facts of sensation, and because the facts of sensation fit better into the general scheme of reactions than the facts of reaction fit into any general scheme based on sensation.

In order to understand human behavior, it is desirable to know something of the working of the nervous system. The nervous system is composed of neurones. A neurone consists of a cell with its branches, which are of two kinds, axons and dendrites. Internally, the neurone shows a peculiar structure of white and gray matter. The gray matter comprises the nerve centers, lower and higher. It

¹ This is the second of a series of notes made by the nurses of the United States Naval Hospital, Norfolk, Va., and of the Pharmacist's Mates' School, Portsmouth, Va., from a course of lectures delivered before them by Dr. E. G. Fleming, associate professor of psychology at William and Mary College.

is made up of nerve cells and their dendrites, of the beginnings of axons issuing from these cells, and of the terminations of the incoming axons. The white matter consists of axons.

A reaction is a response to a stimulus. The stimulus releases energy stored in the organism, and the reaction has a definite form determined by the organism's own machinery of nerves, muscles and sinews. Among very prompt reactions are the "reflex" and the "simple." The reflex reaction differs from the simple in that it usually takes less time; it requires no thought; and, the machinery for it is born in the organism. The machinery for a reflex consists of a sensory organ, a sensory nerve, a nerve center, a motor nerve and a muscle or gland.

The sensory and motor nerves consist of axons, which are branches of nerve cells. The cells for the motor nerves lie in the cord and brain stem, and those for the sensory nerves, in two cases, in the organ (eye and nose), and in all other cases in groups located close beside the cord or brain stem. The white matter of the brain and cord is composed of axons.

Communication from one neurone to another occurs across a space called the synapse. Where an axon terminates, it broadens out into a thin plate, or breaks up into a tuft of very fine brushes (the end-brush). This makes close contact with the muscle, the sense organ, or the neurone with which it connects. If the connection is with another neurone it takes place across the synapse to the dendrites of the second neurone.

The nerve current is a reflex, and therefore runs the following course: From the sense organ into a sensory axon, along this to its end brush in a nerve center, and across a synapse there into the dendrites of a motor neurone, and thence out along the axon of this neurone to the muscle or gland that executes the reflex. This is a two-neurone arc, but there is often a third control neurone between the first and the second.

Coordination is effected by the linking up of the axons of the sensory and central neurones, by which means the nerve current is harnessed to a team of sensory neurones and so to a team of motor neurones. The most distinctive part of any reflex arc is likely to be its central neurones, which are believed to play the chief part in coordination and in determining the peculiarities of any given reflex, such as its speed and rhythm of action.

In describing the structure of the axon, Professor Fleming spoke of an interesting theory as to the possibility of a method of controlling the development of intelligence. The axon is protected or insulated by a sheath called the myelin sheath. The theory is that there is a relation between the development of this sheath, and motor function, and intelligence. Does the development of this

sheath precede or parallel motor function? Might there be a possible method of controlling the development of intelligence by controlling that of the sheath?

He spoke of phrenology and assured us that we might have no hesitation in pronouncing it BUNK, spelled with four capital letters and three exclamation points. The phrenological hypothesis is that mental faculties or traits of character are shown by the conformation of the skull, or that there is an enlargement of that part of the anatomy where the center controlling the faculty or trait is located in a person who has that trait in a superlative degree; it would follow, therefore, that, as the emotions are controlled by the sympathetic nervous system and the center of amativeness is in front of the sacral portion of the spinal column, the man with a big stomach would be the best lover!

REACTIONS OF DIFFERENT LEVELS

Having defined a reaction as an act of the individual aroused by a stimulus, it follows that a great variety of mental processes may be included under the head of "reactions." All mental phenomena, whether movements, sensations, emotions, impulses, or thoughts, are a person's acts, but every act is the response to some present stimulus. While speaking of sensations and thought as belonging under the general head of reactions, it is well, however, to bear in mind that all mental action tends to arouse and terminate in muscular and glandular activity. A thought or a motor response tends to "express itself" in words or (other) deeds. The motor response may be delayed or inhibited altogether, but the tendency is always in that direction.

To call all mental processes reactions means that it is always in order to ask for the stimulus. There are two classes of stimuli:

A. Peripheral: (1) External, as light or sound striking an organ; (2) internal, as hunger and thirst.

B. Central, as a thought which arouses an emotion.

Brain activities of all sorts influence the muscles by way of the motor area and the lower motor centers. A "center" is a collection of nerve cells, located somewhere in the brain or cord, which gives off axons running to some other center or out to the muscles or glands, while it also receives axons coming from other centers or from sense organs. These incoming axons terminate in end brushes and so form synapses with the dendrites of the local nerve cells. The axons entering any center and terminating there arouse that center to activity, and this activity, when aroused, is transmitted out along the axons issuing from that center, and produces results where those axons terminate in their turn.

The lower motor centers, called also reflex centers, are located in the cord or brain stem, and their nerve cells give rise to the axons that form the motor nerves and connect with the muscles and glands. A muscle is thrown into action by the nerve currents from its lower motor center.

The principal higher motor center is the motor area of the brain, located in the cortex or external layer of gray matter in the cerebrum. The motor area is itself aroused to action by nerve currents entering it through axons coming from other parts of the cortex; and it is by the way of the motor area that any other part of the cortex produces bodily movement.

The difference between reactions of the higher and lower centers may be illustrated by the case of a man sitting on a fence with his legs dangling, and seeing a snake coiled on the ground under his feet. He swings his legs to the top of the fence out of reach of the snake. This action, even though impulsive and involuntary, has been aroused by way of the motor area and is a response to the knowledge of what that object was and signified, and knowledge means action by the cerebral cortex, which effects movement through the medium of the motor area. But if the snake had made the first move, the same leg movement on the man's part, made in response to the painful sensory stimulus, would have been the flexion reflex.

Not only can the motor area call out essentially the same movements that are produced reflexly, but it can prevent or inhibit the execution of a reflex in spite of sensory stimulus or it can reinforce or facilitate the action of the sensory stimulus so as to assist in the production of the reflex.

Another important effect of the motor area upon the lower centers consists in combining their action so as to produce what we know as skilled movements. It appears that the essential work in producing these higher coordinations of skilled movement is performed not by the motor area, but by neighboring parts of the cortex, which act on the motor area in much the same way as the motor area acts upon the lower centers. Some of these skilled-movement centers, or super-motor centers, are located in the cortex just forward of the motor area, in the adjacent parts of the frontal lobe. Destruction of the cortex there, through injury or disease, deprives the individual of some of his skilled movements, though not really paralyzing him.

Let a noise strike the ear and start nerve currents in along the auditory nerve, passing through the lowest and intermediate centers and reaching the auditory-sensory area of the cortex. When this last is aroused to activity we have a sensation of sound, which is the first conscious reaction to the external stimulus. Axons running from the auditory-sensory to the near-by cortex give a perception of some fact indicated by the external stimulus, and this perception is

a second and higher conscious reaction, which, to be sure, ordinarily occurs so quickly after the first that introspection can not distinguish one as the first and the other as second; but the facts of brain injury, already mentioned, enable us to draw the distinction. The perceived fact may call up a mental image, or a recognition of some further fact less directly signified by the noise; these would be reaction of a still higher order. Much of the cortex is apparently not very directly connected with either the sensory or the motor areas, and probably is concerned somehow in the recognition of facts that are only very indirectly indicated by any single sensory stimulus, or with the planning of actions that only indirectly issue in muscular movement.

On the sensory and intellectual side, the higher reactions follow the lower; sensation arouses perception and perception thought. On the motor side, the lower reactions are aroused by the higher. Thus the speech center arouses the motor centers for the speech organs, combining the action of these into the speaking of a word; and in a similar way, it seems, the intention to speak a sentence expressing a certain meaning acts as a stimulus to call up in order the separate words that make the sentence. A general plan of action precedes and arouses the particular acts and muscular movements that execute the plan.

TENDENCIES TO REACTION

STIMULUS-RESPONSE POINT OF VIEW

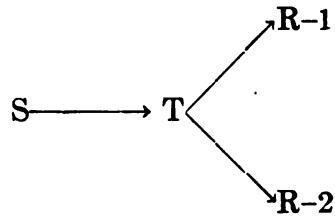
A stimulus is anything received by sense organs. Stimuli may lead to attitudes or tendencies. There are two schools of thought which lean toward and away from behaviorism. The behaviorist idea may be diagrammed thus: S——O——R, the organ being controlled by the stimulus. The dynamic idea is that the condition of the organ is included in the stimulus and may be diagrammed thus: O——→S——→R.

A response may be motor or mental, as sensation or thinking. There may be a neuro-response, or a glandular response, or a response of the sympathetic nervous system giving relatively complex activity. Each response is a stimulus to the next response. Psychology is not interested in ethics. It does not say "ought," but only "how" and "why."

The advantages of the stimulus-response point of view are that: It keeps close to the facts; it has room for introspective as well as behavior study; it can be applied practically.

The symbol of stimulus-response psychology may be written thus: S——→R. S means the stimulus and R the response. The line between is the connection from stimulus to response. This represents the simplest form of response-stimulus behavior, such as withdraw-

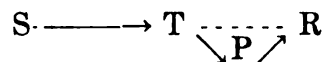
ing the finger from a hot surface. In order to represent more complicated activities which result from motives, interests, and purposes, a more elaborate diagram is necessary:



Here T means an inner motive or tendency, which, aroused by an external stimulus, itself arouses a motor response. If the reaction-tendency were linked so firmly to a single response as to arouse that response with infallible certainty and promptness, then it would be superfluous for psychology to speak of a tendency at all. But often quite a series of responses, R-1, R-2, etc., follows upon a single stimulus, all tending towards the same end-result, such as an escape; and then the notion of a "tendency" is by no means superfluous.

Stimulus purpose: A stimulus is typically external; a purpose internal. A stimulus typically acts for a moment; a purpose persists for some time. A stimulus is not directed towards a result; a purpose is so directed.

Purposive behavior is on three levels: (1) Organic or physiological states that predispose towards certain forms of behavior; (2) inner adjustments towards certain results, without foresight of the results; (3) conscious purpose. Purposive behavior may be diagrammed thus:



A stimulus arouses the tendency towards the end reaction, R, but (as indicated by the dotted line) T is not sufficient by itself to arouse R; but T can and does arouse P, a preparatory reaction, and P (or some external result directly produced by P), cooperating with T, gives rise to R.

The lowest level, that of organic states, is typified by fatigue. The middle level, that of internal steer, is typified by the hunting dog, striving towards his prey, though, not so far as we know, having any clear idea of the result at which his actions are aimed. The highest level, that of conscious purpose, is represented by any one who knows exactly what he wants and means to get. Organic states are aroused by stimuli, they persist for a time and they influence the response to other stimuli.

For example, fatigue is an organic state; it persists until the blood carries away the wastes in the muscles which produce it; it

influences the response to other stimuli, such as an electric shock (response of the fatigued muscle is more feeble).

Preparatory reactions are neutral rather than chemical; they amount to a preparation or readiness for a certain response; they persist sometimes for only a few seconds, sometimes for many minutes, at least. Example: The dog in quest of prey is stimulated by hunger, an inner organic state which arouses the tendency to eat. He prepares to eat by hunting for prey and begins at once to respond to present objects by dodging them or by finding his way by them in his quest for food. These responses are preparatory reactions, and, if successful, put him in the presence of food. That is to say, the preparatory reactions of running and dodging obstacles provide the stimulus, sight, or smell of food, that is necessary to arouse the end reaction of eating.

Tendency means the arousing of a nerve center under conditions which do not allow that center to discharge at once. The center remains in a condition of tension; energy is dammed up there, unable to find an outlet. Tendencies: A whole series of acts may be set going by a single stimulus; the series comes to an end when a certain result has been reached; each act in the series is a response to some particular stimulus, and yet would not be aroused by that stimulus except for the active adjustment toward the end results; the end result can not be reached until a particular stimulus helps the adjustment to arouse the end reaction; the preliminary acts in the series bring the required stimulus that can give the end reaction. Conscious purpose: Desires or motives may be present. Desire may be kept alive by a continuing peripheral stimulus. It may be unable to discharge fully, because its main path of discharge is blocked. Motives: The main center of the nervous system has minor connections with other centers, in addition to its main path of discharge. The persisting activity of the main center influences other centers by way of facilitation and inhibition.

NATIVE AND ACQUIRED TRAITS—INSTINCT

The distinction between native and acquired traits is clearest in the field of anatomy. Scientifically the distinction is imported as the starting point of a genetic study; practically it is important because there is reason to believe that native traits are deeply seated and can not easily be eradicated, even though they can be modified and specialized in different ways. Criteria: (*a*) Is a trait present at birth? If so, it is probably native. (*b*) Is there a possibility of its having been learned? For example, has the individual had time to learn it, as walking? (*c*) Is it universal? This test must be used with care, for a trait may be universal through having

been imposed. The criterion of universality may be stated thus: When all individuals having the same descent show a trait in common, that trait is to be regarded as belonging to their native constitution, unless evidence can be brought forward to the contrary. On the other hand, a trait may be native, but far from being universal, as, for example, genius, or blue eyes.

Acquired traits are, on the whole, much more individual than native traits. They are not independent of native, but are developed on the basis of the native traits.

Superior or inferior intelligence is native and is related to the weight of the brain though the correlation is not close. The nerve cells are present at birth and the growth of axons, neurones and dendrites is a natural development. The number of native traits that can be shown to be present is:

At birth.....	390
At the end of first year.....	934
At the end of second year.....	1,025
At the end of third year.....	1,100
At the end of fourth year.....	1,300

At the end of the eighth year, 1,375, which approaches normality. There is considerable variability in the development, but the average approaches normality at the end of the eighth year.

All of the sensory equipment is present at birth or within two weeks. There are four fundamental tastes—sweet, salt, bitter, and sour—all of which are present at birth. All other tastes are combinations of these.

The action of the sympathetic nervous system and of the ductless glands is native. Among the glands of interest to the psychologist are the adrenal, thyroid, thymus, pineal, and pituitary. The thymus controls the development of sexual activity. It normally disappears at about the thirteenth year, and if it continues beyond the fourteenth, produces the condition known as "angel face". The thyroid is important in two respects. Underactivity causes cretinism and overactivity causes hyperthyroidism. The pineal seems to cooperate with the thymus. The pituitary cooperates with the pineal and thymus and controls the growth of the long bones. The adrenal gland is concerned with the emotions.

Certain reflexes are native. Irritability is native, being in the very nature of living matter. Any neurone responds when in a state of unsatisfaction, but is said to be in a state of equilibrium when satisfied.

Instinct is native behavior. No sharp distinction can be drawn between reflexes and instinct, but instinct may be defined as an innate tendency to respond. The nesting instinct of birds affords complete example of instinct. The end result here, the finished

nest, can not be instantly had, and the pair of birds keep on gathering materials and putting them together until this end result is present before their eyes. It is not necessary to suppose that the birds have any plan or mental image of what the nest is to be like; probably not. But their state, in the nest-building season, is such that they are impelled to build, and the tendency is not quieted till the completed nest is there.

Insects afford the best examples of highly organized instincts. By contrast, the instincts of mammals are rather loosely organized. Mammals are more plastic, more adaptable, and at the same time less sure; and this is notably true of man. In man the powers of observation, memory, and thought are drawn into the game, and thus instinct is complicated and partly concealed by learning and reasoning. The human organism has the capacity for random activities and also for attending to stimuli. Some activities are satisfying in themselves, as in the play of children.

The will is ordinarily considered very important, yet we wonder if there is any such thing. It does not fit in with any scientific concept. The more intense stimulus brings the response; also, when there is a change of stimulus the change gets the attention. Besides, we learn what to do; the child has no innate morality. The expedient thing to do seems to be to teach the child to respond as if he had a will until he has formed the habit of acting as if he had one. We should act as if we had will, study as if we had not.

The innate capacity for remembering; that is, retentiveness, can not be improved. That with which an individual is born is all that he will ever have, but a poor memory does not necessarily mean poor retentiveness; it may mean a poor method of using the native retentiveness. So called memory courses are really courses in methods.

Imitation is a disputed point in psychology. It is held by some that speech is learned by imitation. The human organism makes all of the sounds possible to the vocal organs before it learns to talk. The infant finds making sounds satisfying to the neural organism and so makes them over and over again—a circular reflex. When it says “da-da” and a certain individual responds in a pleasurable way, it comes to associate that sound with that individual, and so with other sounds and objects. It learns some by the process called imitation (conditioned response). Exact imitation, however, is impossible. Imitation in adults consists of observation plus trial and error.

Integration: There is a tendency of the organism to maintain itself as an organized living unit, a tendency toward consistency.

Certain instincts are manifested toward external things. Toward society this is shown as the herding instinct or gregariousness, and

in crowd behavior, which is a tendency to act in such a way as to win the approval of his kind.

Emotional capacity: If there is a conflict between thought and emotion, emotion will have its way. There are three innate emotions—love, rage, and fear. Collingsworth adds disgust and a sense of comfort. All other emotions are built up of these or combinations of these. Emotion is a response. The love response in an infant is a general feeling of well being brought forth by the stimulus of certain erogenous zones by stroking or very gentle tickling. Anything beyond this is learned. The rage response is brought forth by only one stimulus—the physical hampering of movements. The fear response is brought forth by two stimuli—a loud and sudden noise and the loss of physical support.

(To be continued)

NOTES AND COMMENTS

MANAGEMENT OF SYPHILIS

The February number of Venereal Disease Information, published by the United States Public Health Service, devotes 36 pages to an article on the management of syphilis in general practice. The authors, J. E. Moore, in collaboration with such well-known authorities as H. N. Cole, J. F. Schamberg, H. C. Solomon, U. J. Wile, and J. H. Stokes have put into this small space the most modern and comprehensive and valuable symposium on the subject that has yet been seen, and one which all naval medical officers, eminently concerned as they are with the problem of syphilis, could read with distinct profit.

The subject of prophylaxis is dealt with from the social and medical aspects, with which medical officers are already thoroughly familiar. The medical formulæ and technique recommended are those that have been in standard use in the Army and Navy.

In discussing the examination of the patient the too-frequent custom of examining only the presenting lesion is strongly condemned and it is considered of great importance to make and record a careful physical and neurological examination before undertaking to treat a patient. This may reveal unsuspected syphilitic lesions as well as coexisting diseases which will play an important rôle in the patient's reaction to the infection or in his response to treatment.

Under diagnosis of early syphilis, the point is made that this is strictly a laboratory procedure, as the diagnosis can never be made with certainty by the appearance or "feel" of the chancre. The dark field is 90 to 95 per cent efficient during the first ten days of the chancre, while the blood Wassermann is 40 per cent efficient during that period. Until the fifth week the dark field is 80 per cent efficient in untreated cases. After the sixth week the Wassermann is almost always positive while the dark field is no longer reliable. "Every genital sore, and every extra genital sore which fails to heal promptly, should be regarded as possibly syphilitic until it can be proved to be otherwise." The proper dark field technique is described in detail.

In cases of secondary syphilis the patient must be stripped and examined under a good light; otherwise a rash unknown to the

patient may escape observation, and lesions about the mouth, soles, palms, and anus will not be noted. Certain indurated lymph nodes may also thus remain undetected.

These authors consider arsphenamine the most efficacious of the arsphenamines in the treatment of early syphilis, and they believe that the more widespread use of neoarsphenamine has been due to the dangers of improper preparation of the arsphenamine solution and the much greater time required for this preparation. The advantages of arsphenamine are: Its therapeutic superiority, its greater chemical stability and its relative cheapness. The advantages of neoarsphenamine are: Its greater safety in the treatment of cardiovascular syphilis, its smaller tendency to cause gastro-intestinal reactions, its greater tonic effects, its smaller probability of producing thrombosis and its greater simplicity and ease of injection. Sulpharsphenamine has the advantage of being the only arsphenamine tolerated intramuscularly; it moreover produces fewer immediate reactions, is convenient when patients have veins difficult to enter; and there is evidence of its superiority in penetrating the nervous system. Tryparsamide is accepted as the drug of choice in neurosyphilis (especially early paresis), and may be used before or after the malaria treatment. It has a marked tonic effect, is easy to give, causes no reactions (except the visual damage) and is usable in patients who have had arsphenamine dermatitis.

A very complete set of directions are given for the preparation of arsphenamine and neoarsphenamine solutions, together with dosages, methods of injection, etc.

The question of reactions is discussed in full with the most recent methods of their prevention and treatment.

The question of the relative value of mercury and bismuth is one not yet decided, but for certain reasons, in many treatment centers, bismuth has partly replaced mercury in the treatment of early syphilis. The inunction method of giving mercury is for many good reasons the route to be preferred. Printed instructions for the rubbing should be given to the patient in order to insure that this is properly carried out. An excellent set of these directions is included in the article.

In early syphilis the continuous system of treatment is preferable to the intermittent system, the courses of an arsphenamine being alternated with courses of either mercury or bismuth.

The most difficult thing to decide about the treatment of early syphilis is how long it should be continued. In this connection some very instructive and convincing data is presented. Results obtained by Moore and Kemp in the treatment of early syphilis are as follows:

Eight doses of arsphenamine, or less, without mercury, 10 per cent cured.

Two courses arsphenamine with interim mercury, 37 per cent cured.

Three courses arsphenamine with interim mercury, 56 per cent cured.

Four or more courses arsphenamine with interim mercury, 78 per cent cured.

"The optimum amount of treatment for early syphilis with the plan advocated is one full year of treatment after the blood and spinal fluid have become and have remained negative."

As to criteria of cure "the only definite evidence of cure of syphilis in man is reinfection." A year of probation, during which the patient receives no treatment, develops no syphilitic lesions, and the blood Wassermann, done every two months, remains negative, is encouraging evidence if followed by a complete physical and neurological examination which "show no evidence of progress in the disease, especially in the nervous system or cardiovascular apparatus—a physician who dismisses a patient as 'cured' without a routine spinal puncture is criminally negligent."

Wassermann fastness means in 90 per cent of cases that the patient belongs in one or more of the following groups, which are listed in their order of relative frequency.

1. Syphilis of the central nervous system.
2. Cardiovascular syphilis.
3. Bone syphilis.
4. Late congenital syphilis.
5. Visceral syphilis (other than cardiovascular involvement).

In the treatment of late syphilis the object is quite different. Here the treatment is directed rather toward the prevention of further destruction by the disease, and consists in the persistent use of the arsphenamines, bismuth, mercury, and the iodides, in such doses as will avoid reactions or injury. The later in the course of the disease the more highly individualized the treatment must be.

A COMPARISON OF THE PRACTICAL VALUE OF THE WASSERMANN AND KAHN TESTS

Col. C. F. Craig, Medical Corps, United States Army, writing in the American Journal of Syphilis of April, 1929, presents certain definite advantages of the Wassermann and believes that both the Wassermann and Kahn tests should be done in cases of doubtful diagnosis.

In many febrile conditions and in other diseases than syphilis the Kahn gives a much higher per cent of positives than the Wassermann does and because of this feature is of less practical value than the Wassermann.

On the other hand, the Kahn gives a positive result earlier in primary syphilis than the Wassermann does, and also gives a greater per cent of positives in treated and latent cases, thus possessing a feature of distinct value.

Colonel Craig considers that in spite of its many advantages the Kahn test is too sensitive for use as an exclusive test for the diagnosis of syphilis in the Army.

Much of the sera tested in the service is sent from a distance, and, being frequently contaminated and blood stained, is not suitable for a Kahn; and a Wassermann is required, since this contamination will not interfere with the reading of the Wassermann.

The more desirable system appears to be the availability of both tests in a service laboratory, so that either may be used as indicated, or both be used as counter checks in cases of doubtful diagnosis. The Wassermann appears to be the more applicable in the greater number of cases.

THE TREATMENT OF CHANCROID AND BUBO

Elsewhere in this issue Doctors Potter and Redewill have reported on certain methods in the treatment of chancroid and bubo and have stressed the importance of thorough cleansing and of air exposure, along with other agents which they believe have a rather specific value.

Dr. H. N. Cole, professor of dermatology and syphilography at Western Reserve University, has covered the subject in an article which will be of particular appeal to naval medical officers and others having a more than ordinary experience in or knowledge of these conditions.

Doctor Cole's article appeared in the January, 1929, number of Venereal Disease Information, a monthly publication of the United States Public Health Service.

Doctor Cole believes also that crusting and inaccessibility to cleansing predispose to bubo formation. Other factors which may tend to spread chancroidal infection and form bubo are certain medical measures and severe types of local treatment which have often been used in the past.

There is unquestionably general agreement with and approval of his statement that "the tendency in the treatment of chancroid is more and more to the use of cleanliness and of soothing astringent, nonirritating remedies. Hot boric acid or hot weak potassium permanganate soaks are of great assistance. The organisms of chancroid grow best in a moist medium shut off from the air. Therefore exposure of the lesion to the air and to dry heat is advisable."

He advises circumcision in early cases that can be controlled by hospital rest and observation. This procedure removes lesions, makes the ulcers accessible, and allows better local therapy. Clips are used instead of sutures and hot soaks and dry heat are used instead of dressings.

He reports excellent results by the incision and injection method in the treatment of buboes. For this, rest in bed, preferably in a hospital, is essential. A slight nick is made at the lower edge of the bubo, and the pus gently expressed. A tight bandage is applied and the patient lies flat in bed with legs unflexed for 24 hours. Again the pus is evacuated and 1 or 2 cubic centimeters of Mencières solution (iodoform, guaiacol, eucalyptol, and alcohol, each 10; balsam of Peru, 30; ether, 100) is injected into the cavity by means of a Record syringe, the nozzle of the syringe (without needle) being forced into the small aperture that was made 24 hours before. This fluid is allowed to remain in the gland cavity for one minute. The compression bandage is reapplied and allowed to remain in place 48 hours, the patient keeping to his bed. The cavity is then again evacuated and another compression bandage applied for 24 hours.

At the end of this time, if the cavity still continues to discharge pus, another injection of Mencières solution is made as noted above.

In Doctor Cole's experience with this method one treatment usually sufficed in curing the bubo. If pus continues to discharge, an injection is made every third day. The hospital bed days and total sick days were considerably lessened among his patients after the adoption of the technique described.

CLINICAL SIGNIFICANCE OF CARDIAC ASTHMA

In a group of 250 patients with cardiac asthma discovered in the past few years among 3,100 private and hospital patients with organic heart disease (8 per cent), and analyzed by Robert S. Palmer and Paul D. White, in the *Journal of the American Medical Association* of February 9, 1929, 180 were males and 70 females, and all but 14 were over 40 years of age.

The grave prognostic significance of the condition is shown by the fact that 170 of the 250 patients are known to have died, with an average duration of life of 1.4 years after the first attack of cardiac asthma.

The largest number of cases, 187, was found in the group of patients with coronary disease, hypertension, or both (10.7 per cent of this etiologic group), but the highest relative incidence occurred in syphilitic heart disease (21 per cent) and in chronic nephritis (19 per cent).

Left ventricular failure due to any one or a combination of several factors appears responsible for cardiac asthma, but the exact mechanism is not clear.

The frequency, duration, and severity of the attacks altered the prognosis appreciably only when of extreme degree. The coincidence of poor heart sounds, gallop rhythms, and pulsus alternans indicated, as a rule, a very short life. Aortic regurgitation, usually of syphilitic origin, was the only common valve defect (63 cases of the 250).

In therapy, digitalis and rest were generally effective in reducing the number of attacks and apparently in prolonging life; for the treatment of acute attacks nitrates and alcohol were sometimes helpful, but morphine was of the greatest value.

A SIMPLE EXERCISE TOLERANCE TEST

The chief objection to exercise tolerance tests which have been in use is that they are not strictly quantitative nor readily capable of establishing standards for normal individuals. There has been need of a test which will permit accurate measurements of the work performed, which will involve no unusual types of muscular activity, and which will be simple enough for use in the ordinary office or clinic.

An accurate quantitative test which can be applied to all types of subjects would be helpful in diagnosing and following the clinical course of cardiac and circulatory conditions.

A. M. Master and E. T. Oppenheimer have described in the *American Journal of the Medical Sciences* of February, 1929, a test which appears to meet all these desired requirements.

For this test there is used a simple two-step contrivance (two steps up on one side and two steps down on the other, the steps being each 9 inches in height).

After blood pressure readings are made, the patient ascends and descends the steps for one and a half minutes, resumes his seat, and the exact time is noted when the blood pressure and pulse return to their preexercise level.

The test is repeated until a determination is made of the maximum number of ascents and descents that must be made in the minute and a half in order to delay the return to normal resting conditions beyond the prescribed two minutes. A calculation can then be made of the work performance necessary to cause this delay. The calculation in foot-pounds is made by multiplying the weight of patient by the number of ascents and by $1\frac{1}{2}$ (because of the two steps of 9

inches each). To determine the work done per minute, the foot-pounds of work performed may be divided by $1\frac{1}{2}$.

$$\text{Thus work per minute} = \frac{\text{wt} \times \text{ascents} \times 1\frac{1}{2}}{1\frac{1}{2}}$$

or may be simply calculated by multiplying the weight by the number of ascents.

The authors examined 115 normal subjects to determine standards for persons of different types as to weight, height, age, and sex.

Graphs were plotted with foot-pounds of work as ordinates, and age, weight, and height respectively, as abscissæ. From these graphs standard tables were prepared for each sex. Men at the optimum age have a work capacity of about one-eighth horsepower, and women about one-eleventh horsepower.

Exercise tolerance varies directly with weight up to the optimum of about 160 pounds for men and 140 pounds for women. Beyond these weights the exercise tolerance falls. Exercise tolerance varies directly with height.

This test, besides being helpful in diagnosis, may be brought into use in giving advice as to sports and games.

THE TREATMENT OF SPRUE WITH LIVER EXTRACT

A. L. Bloomfield and H. A. Wyckoff, who, in 1927, reported a case of sprue successfully treated by high liver diet, have reported on two other cases of sprue treated with distinct success by liver extract. These two cases are reported in the American Journal of the Medical Sciences of February, 1929.

Dietary suggestions have been numerous in the treatment of sprue, but until the report of these cases there have been few if any accounts of liver feeding in sprue as it is carried out in pernicious anemia.

The cases reported were symptomatically typical of sprue, and did not appear to be possible cases of pernicious anemia, since they both showed considerable amounts of free HCl in the gastric juice.

Response to the treatment was similar to that usually obtained in pernicious anemia, "with rise in reticulocytes, increase in blood count, and improvement in gastrointestinal symptoms, with gain in weight and general well-being. The results obtained are additional evidence of a close relationship between sprue and pernicious anemia."

RINGWORM OF THE FEET

There is a growing interest in fungus infections and medical literature is giving increasing space to the subject. E. A. Sharp has con-

tributed an interesting article on the treatment of this condition in the April, 1929, *BULLETIN*, and elsewhere in this issue appears a similar article of equal interest by D. S. O'Connor.

"One of the biggest problems in public-health work that is at the present time interesting college physicians, physical educators, military and industrial organizations, athletic clubs, and bathing resorts is epidermomycosis, or ring worm. At the University of California, during the fall semester of 1928, when a compulsory physical examination was conducted by Robert T. Legge in collaboration with Lee Bonar and H. J. Templeton, Berkeley, Calif. (*Journal A. M. A.*, May 4, 1929), for all freshman entrants it was found on carefully searching and examining the toes of 3,105 freshmen, that $52\frac{1}{3}$ per cent of the men and $15\frac{1}{3}$ per cent of the women were infected with ringworm of the feet. This significant fact is evidence that the incidence of the disease is increasing and that it is very common, having already permeated high schools and secondary schools wherever gymnasium and bathing facilities exist. From their survey among all upper-classmen in the University of California, it is safe to estimate that 85 per cent of the men who are required to take gymnasium work are infected. The distribution of ringworm infection is nation-wide. The University of California draws its student body not only from all over the United States but from the whole world. Many of the students are from India, China, and Japan, and it is probable that the fungi may have been imported from these countries. The so-called Hong Kong and Shanghai foot is ringworm infection. When scrapings from the patient with ringworm are mounted in from 20 to 30 per cent potassium hydroxide and allowed to stand for from 2 to 24 hours, the organisms can be readily found by an experienced observer. It has been found that when these dried and "dead" cultures are replanted they grow abundantly and renew their activity, a fact illustrating that drying is not lethal, and destroying of the spores is persistingly difficult. It has been observed that the chief site of infection among students of the University of California is between the toes, particularly in the third and fourth interdigital spaces, very frequently involving the nails. That it may be transferred to the hands, soles, groin, and axillæ by the towel in drying the body, after the same towel has been used on the feet, is a point worth noting. The clinical types as observed by Legge et al. are chiefly the sodden interdigital, which is most common, then the vesicular and the eczematoid types. In quite a few instances a mixed infection with bacteria takes place and a lymphangitis and adenitis may be present."

THE LIMITATIONS OF SCREENS IN THE PREVENTION OF MALARIA

In a portion of Dona Ana County, N. Mex., the malaria rate has rapidly increased during the past three years. The proportion of screened dwellings there is high; so it seemed worth while to make a study of the amount and character of the screening.

This survey was made by M. A. Barber and C. H. King, of the Public Health Service, and their report appears in the Public Health Reports of March 8, 1929.

They found nearly eighteen times as many *Anopheles* in unscreened as in screened houses, most of the *Anopheles* found being *A. maculipennis*.

In a comparison of malaria-infected houses with noninfected houses in regard to screening, the group of infected houses showed a much higher percentage of dwellings wholly unscreened. Those completely screened but lacking screened veranda had about the same percentage in each group. The houses with screened verandas seemed less likely to become infected.

In the course of five visits to one unscreened house in a neighboring Indian village, Pueblito, we found 56, 19, 11, 31, and 32 *Anopheles*, respectively, nearly all *A. maculipennis*, and 2 of them with malaria oöcysts in the mid-gut. The house was then screened, and thereafter we found at two visits only 2 and 1 *Anopheles*, respectively, although the door sagged so much that a wide opening was left at the top.

We would encourage every effort to promote screening, whether by county-wide campaigns, by education, or by whatever means seems most purposeful. This protection is only a part of decent living in a region infested by flies or mosquitoes. Where screens do not wholly protect against the transmission of malaria, they may make a neighborhood slow-burning, epidemiologically speaking, and may make a careful people almost malaria-proof. But one should keep in mind that screening is no panacea against malaria, and that results may come but slowly in regions where merely nuisance mosquitoes are few and where people do not hold an attack of malaria in any particular dread.

THE FUTURE OF SURGERY

In an address delivered before the Academy of Medicine in New York in May, 1928, and published in the Annals of Surgery, of February, 1929, Walton Martin has indicated the present directions of progress in surgery and has shown in a convincing way what may reasonably be looked for in the future.

He discusses the methods by which some idea of the future of surgery may be arrived at. He discards the scientific method as unsuited to so inexact a science as surgery and dismisses the romantic method as too fanciful for one familiar with the difficulties and limitations involved in the practical problems of surgery. "They [the imaginings] seem most real, however, I think, to those

least familiar with the particular branch of knowledge in which the writer is a specialist, for knowledge breeds scepticism, inculcates caution, makes one conscious of the difficulties of accomplishment."

He chooses the historical method as especially well suited because it indicates the trend of the present from an investigation of the past, and instead of attempting any precise prophecies it gives a rough sketch and certain suggestions of what may be expected in the future.

The distinctions made by Sir John Eric Erichsen in 1895 between the art of surgery and the science of surgery hardly apply to-day, and while the predictions made by Erichsen were essentially correct for the 30 years following the time they were written, no predictions can be made at present on the basis he used. To-day the science and art go hand in hand, and surgery is rather "a practice, a way, of treating disease."

There are increasing opportunities to learn surgery and to do surgery. Modern transportation has made the time seem "approaching when there will be no out-of-the-way places." Now the patient comes to the surgeon at the large hospitals and clinics instead of the surgeon going to the patient. A striking change has been in the replacement of the few with extraordinary facility by "a great . . . number of those who are considered highly skilled."

The tendency is toward more painless methods and decreased mortality. The mortality in nephrectomy for tuberculosis has decreased from 30 per cent in 1910 to 2 per cent at present. Increased accuracy in diagnosis and greater safety and painlessness of operations have encouraged more patients to come to the surgeon.

Many of the greatest advances in surgery have resulted from contributions by the allied sciences, and such events should be expected in the future. Röntgen's discovery in 1895 and Edison's lamp in 1879 have already added enormously to diagnostic accuracy, and chemistry will "undoubtedly furnish better local anaesthetics and antiseptics." Compounds "less poisonous and more powerful . . . (will) increase the use of local and regional anaesthesia."

Certain conditions will continue to come to the surgeon as in the past, but in increasing numbers. These are such conditions as injuries, deformities, tumors, foreign bodies, concretions, and hernias.

There may be less, rather than more, surgery in the treatment of lesions of syphilis and tuberculosis, because syphilis is treated so early and effectively that these lesions now rarely occur; and tuberculosis is apparently decreasing.

"The doctrine of focal infections advanced in the last 10 years has had a tendency to increase the number of operations." Doctor Martin believes the tendency to remove these foci will increase and

that "the impulse comes from the reports of striking improvement in a variety of chronic ailments, such as arthritis, neuralgia, headache, lassitude, world weariness, etc., which I assume may even become more frequent in the future."

"Growths in certain regions have passed out of the domain of operative surgery. In carcinoma of the cervix, for example, radium has come to be the method of choice. It is recognized to-day that both surgery and the X ray have a place; that the best we can do for cancer is still to excise it widely."

"One may say that 30 years ago a surgeon was concerned with the anatomical consideration of whether he could remove a given tumor. To-day, having mastered the technical difficulties, he is confronted with the question as to how much he accomplishes with a given mutilation and as to when a given area of chronic irritation is to be considered a precursor of cancer."

The important change which seems to be in progress now is that anatomical are giving way to physiological considerations. In this connection, Leriche, on the occasion of taking the chair of surgery in Strassburg in 1925, said:

Surgery has become one of the most important branches of physiology and if its supreme aim is therapeutic it has equally as an aim the knowledge of the healthy man and the sick man and should be considered as one of the normal procedures in the study of biology. Surgery has arrived at the end of a period largely clinical and technical. It has taken 40 years to arrive at this mastery. During this short period it has accomplished a considerable work; it has acquired an admirable sureness in its acts; it has created its methods, studied the morbid physiology of some disorders, fixed the nature, the pathological anatomy, and the evolution of a great number of diseases; it has prepared the balance sheet of its possibilities and called in its long-term notes. Now, proud but not satisfied, it is at its apogee.

ACUTE OSTEOMYELITIS

Dean Lewis, writing in the Journal of the American Medical Association of March 9, 1929, reports his latest views on osteomyelitis, which are based on his study of 229 cases.

A differentiation is not made between acute and chronic cases. In one of the cases cited operation was performed within 11 hours after the onset. The patients were, however, rarely admitted to the hospital until from 4 to 7 days after the beginning of the attack. There are included in this study 88 cases of osteomyelitis of the femur. Nine of these patients died. Three deaths followed attempts at removal of large, almost total, sequestrums. This experience indicates that too radical a procedure should not be attempted in patients whose resistance has been lowered by long illness. The remaining six deaths were due to general pyogenic infections with metastases.

Three of the patients with osteomyelitis of the femur were unimproved; 59, or 67 per cent, were discharged as improved, while 17, or 19.3 per cent, were discharged as cured. The percentage of improvement is high, but improvement usually means a discharging sinus or unhealed wound and indicates that surgery has not attained its aim—a healed wound. Some effusion or other evidence of joint involvement was noted in a relatively large proportion of cases. The knee was involved in 44 of the 88 cases, the hip in 25, and the hip and knee in 7.

There were 61 cases of osteomyelitis of the tibia; two deaths occurred in this group. The two deaths were due to general infections. There were 63 cases of osteomyelitis of the humerus. One death occurred in this group; 49 patients were discharged as improved, 1 as unimproved, and 12 as well. The elbow was involved in 21 and the shoulder in 19 of these cases; both the shoulder and elbow were involved in 5, and in 64.5 per cent 1 or both joints were involved. One can not but be struck by the number of patients, about 50 per cent, who were discharged as improved. Multiple operations were required for recurring attacks and abscesses. Because such recurrences are so common some surgeons believe that osteomyelitis is never cured.

The author believes that some of the operations which have been suggested for osteomyelitis are harmful. Any operative procedure employed in the treatment of acute osteomyelitis should have as its objects the prevention of general infections, the limitation of sequestration or reduction in the size of the sequestrums, and the prevention of deformities. As is indicated by the figures cited in the 229 cases discussed in this series acute pyogenic osteomyelitis still remains a surgical problem.

The importance of an early diagnosis is emphasized. The diagnosis must be based on pain, which is the constant, predominant, and earliest symptom of acute osteomyelitis, and a definite localized point of tenderness limited in area and not found over the surrounding bone. During the first 24 to 36 hours, pain, localized tenderness, and fever may be the only symptoms of the disease, as the inflammatory process is confined to the interior of the bone and has not yet reached the periosteum, when redness, edema, and induration of the skin are noted. If the sequelæ of acute osteomyelitis—discharging sinuses or reformation of sequestrums—are to be avoided, the diagnosis must be made early and an early operation performed.

When the diagnosis is made, the supporting focus should be drained by a trephine opening or a burr and the tension immediately relieved. If a subperiosteal abscess has formed, this should be drained and further stripping of the periosteum or injury of the bone care-

fully avoided. Removal of the sequestrum should be delayed until it is fully separated, for it is impossible to determine what bone is viable before separation has occurred, and the injury of surrounding viable bone may be followed by sequestrum formation later. The radical operation does not lessen the incidence of general infection. Radical removal of an infected marrow with a curet may favor the development of general infections and destroy bone.

The development of deformities should be prevented. The surgeon can prevent these. The possibility of a dorsal dislocation of the hip should always be kept in mind in inflammatory processes about the hip, especially in osteomyelitis of the upper and posterior part of the rim of the acetabulum, which is supplied by an artery that may be closed by an infected embolus.

Improvement in the treatment of acute osteomyelitis depends on early diagnosis and the resort to drainage of the inflammatory focus in the bones. Periosteal stripping should be prevented. If a subperiosteal abscess has formed, this should be incised. Removal of the sequestrum should be postponed until it has completely separated so that in removal healthy surrounding bone will not be injured by operative procedures. Trauma to surrounding bone may lay the foundation for the formation of a new sequestrum.

FASCIAL TRANSPLANTS IN TREATMENT OF CERTAIN DISLOCATIONS

Alexius McGlannan has described in the Journal of the American Medical Association of May 11, 1929, two cases of acromioclavicular dislocations which he has repaired by means of fascial transplantation with excellent results.

In both cases the dislocation was of the incomplete variety, in that the conoid and the trapezoid ligaments were not torn. A strip of fascia lata was taken from the thigh and one end threaded into a suitable needle. A curved incision was made to expose the outer end of the clavicle and the adjacent portion of the acromion. The torn ligaments and the periosteum were elevated and a hole was drilled in each bone. By the use of a wire loop, the fascial strip was drawn from above downward through the clavicle and from below upward through the acromion. The needle was then passed through the fascia close to the bone and the loop drawn down tight. The remnants of the superior acromioclavicular ligament and the elevated periosteum were then woven with the fascial suture over the joint. Both patients recovered without complications and were discharged with good shoulders.

He has treated one case of posterior radio-ulnar dislocation by the use of a fascial transplant to restore the torn ligament. The

dislocation had been present one month, and nonoperative treatment failed to keep the head of the ulna in place. At the operation the lower ends of the right radius and ulna were exposed by a posterior incision, with retraction of the tendons. A hole was drilled obliquely through the radius just above the sigmoid cavity, coming out in front of the posterior ridge. A strip of fascia lata threaded on a needle was first sutured through the periosteum of the radius and the remnant of the posterior ligament, it was then carried through the periosteum on the distal side of the ulna, brought back over the head of the ulna and carried through the drill hole in the radius. While the bones were held in apposition, the fascial strip was crossed through itself and sutured down with catgut. The wound was closed and the arm splinted in supination. The patient recovered without any complications and returned to duty four months later. At the present time, three and one-half years after operation, he continues to do hard work, with full and free movement of the wrist and complete function of the hand.

SYMPATHECTOMY AND PARAVERTEBRAL ALCOHOL INJECTIONS IN THE TREATMENT OF ANGINA PECTORIS

Renewed interest has in recent years been shown in the treatment of angina pectoris by sympathectomy. This method of treatment was first suggested by François Franck in 1899 and first carried out by Jonnesco in 1916.

Two papers by E. C. Cutler in 1927 summarized the cases which had appeared in the literature and indicated the possibilities of surgical treatment of angina pectoris. Further impetus was given to this field of work in 1926, when G. I. Swetlow reported relief of pain by means of paravertebral injections of alcohol directed to block the communications of the cervical sympathetic chain with the central nervous system.

Edward P. Richardson and Paul D. White, writing in the American Journal of the Medical Sciences of February, 1929, report in detail eight cases treated by operation and an equal number by alcohol injections. Their comment on these cases and their conclusions are a distinct addition to what has already appeared in the literature on the status and value of the procedures.

They ask the question: "Do these methods of treatment constitute good therapeutics, and if so, to what extent?" In answering the question they use such criteria as operative mortality, the degree of relief immediately obtained, the permanence of relief, the effect on the duration of life, and consider the questions of possible harm from the removal of a warning symptom, the possible benefit from the removal of shock excited by the pain of angina pectoris, or the pos-

sible benefit to the heart by affording more exercise than the recurrent pain would allow.

One fortunate feature of their case reports is that considerable periods of time have elapsed since treatment in these cases, whereas most cases previously reported have been published rather soon after operation.

The value of these measures can only be established through the accumulation of the late results of a large number of cases, and great care will have to be exercised in the matter of selection of cases to make certain that those treated are real angina pectoris cases as distinguished from other forms of cardiac pain.

Among the eight operated cases reported there were two operative deaths. Four of the eight cases derived a lasting benefit following operation. In only one case out of five was there relief following removal of the left superior cervical ganglion alone. Four of the cases were of syphilitic etiology. Only one of that group is still alive. 33 months after operation. Among three cases of arteriosclerotic origin, "two were alive and greatly relieved" 57 months and 17 months, respectively, after their operations. One of those three "died seven weeks after operation, apparently of coronary thrombosis."

In selecting cases for the alcohol injections, those chosen were "either incapacitated or bedridden on account of the severity and frequency of their attacks. Three of them had coronary thrombosis and would not have been suitable risks for operation; they survived the paravertebral alcohol injection without difficulty."

A consideration of the results has led the authors to conclude that—

Paravertebral alcohol injection, generally of the left upper five thoracic nerve roots, may be recommended in the treatment of obstinate angina pectoris which persists in spite of ample medical measures, and which renders work impossible and life miserable. Given these indications, there seem to be no contraindications. The injections may be made even after coronary thrombosis, and doubtless are much less of a risk than is cervical sympathectomy. It is quite possible that failure of a paravertebral alcohol injection may justify operative procedures, but our experience to date would indicate that the therapy of first choice for angina pectoris when medical measures have failed is the injection method.

TRAINING YOUNG WOMEN FOR NAVY DUTY IN SCHOOLS OF NURSING

Miss J. Beatrice Bowman, superintendent of the Navy Nurse Corps, writing in *The Modern Hospital* of June, 1929, has given a very clear account of the Navy Nurse Corps. Although she touches on many points already known to most medical officers and Navy nurses, one can not read the article without becoming further informed on the subject, and it should be of particular interest to nurses who are considering service in the Navy.

A young woman who takes up nursing as a profession must realize that she is entering upon a life of service and all nurses should know the status of the Navy nurse.

Although nurses in the Navy do not actually have relative rank, they are classed as officers in respect to privileges and to matters pertaining to the performance of their duties.

The same fundamentals are required of a Navy nurse as of nurses in civilian institutions. A nurse who wishes to become a Navy nurse, however, in order to be a success, should have natural executive ability and should be able to impart knowledge to others. Her patients, as a rule, are men, and she must be able to govern large groups of men without antagonizing them.

Many young nurses who receive an appointment in the Navy Nurse Corps resign at the end of six months because they feel they are unable to manage a large ward. To be successful in the Navy, a nurse should have previous executive experience, and if she is unable to get it during a period of training she should secure it through postgraduate work.

As the character of the Navy nurse's work involves constant supervision and instruction of the hospital corps men, she should have a more liberal theoretical foundation upon which to develop these qualifications than is ordinarily included in the general scheme of training nurses in the schools of to-day. It is, therefore, necessary, for a nurse in the Navy to be able to teach as well as take care of the sick.

The Bureau of Medicine and Surgery encourages its nurses to keep in touch with professional organizations and provides tuition for such postgraduate courses as will benefit the individual as well as the service, and at the end of three years, the length of time necessary for adjustment to the peculiarities of the naval service, requests for courses in physiotherapy, anesthesia, laboratory, and dietary work are given favorable consideration.

Many of the nurses in the Navy improve their off-duty time with study, music, or lectures and enjoy the educational advantages, geographic and historic, that abound in the various places where naval hospitals are situated.

THE PUBLIC HEALTH SERVICE OF HAITI

The many medical officers who have served in Haiti, particularly those who have served in Haiti's Public Health Service, will find in the annual report of the Director General of the Public Health Service of Haiti for the fiscal year ended September 30, 1928, a record of facts and figures which opens to them a world of something to contemplate.

This is a record of the year's accomplishments of an organization which includes some 20 naval medical officers and some 40 Haitian doctors, and which is charged with the sanitation, medical care, and medical education of a land inhabited by nearly 3,000,000 people. The vast scale upon which this work is carried out offers in all its details much information of special concern and value to those interested in social medicine, particularly social medicine in the Tropics. The year's achievements, both because of the remarkable nature of some of them and because of their stupendous volume, afford a certain pride and no small measure of romance to the medical officers who have served or are serving in that organization and who are acquainted with the struggles of the past which have resulted in the rich fruit of the present.

With unprecedented floods in the North during November (1927), an alarming epidemic of meningitis near Cape Haitien in April (1928), and the devastating hurricane of August 10, 1928, on the southern peninsula, the year has been an eventful one, indeed. The losses of life, property, roads, and trails incurred in storms and floods, the disturbance of the country's economic and foreign relations by the epidemic, unfortunate as they were, nevertheless have served the useful purpose of bringing forward into the glare of publicity the magnitude of tasks that lie ahead.

Some of the outstanding events of the year have been: The institution of a quinine-distribution program similar to those existing in Italy, Greece, and Jamaica; the establishment of a health center for inspection of school children and public-health nursing in Port au Prince; the completion of chlorination units for the 7 water supplies of Port au Prince (there were 7 cases of typhoid, with 2 deaths, during the year as compared with 232 cases and 52 deaths the previous year. The yearly average of deaths from typhoid for the four preceding years was 38.7).

The service expended \$796,701 during the year, and when it is considered that, of the total expenditures of the State, 8.9 per cent was for public health, it is apparent that the Haitian Government has a more than ordinary appreciation of the importance and value of the health of a nation.

To give one an idea of the increasing magnitude of work this organization is carrying on the following table is cited:

	1925-26	1926-27	1927-28
Admissions.....	8,624	7,651	8,844
Discharges, exclusive of deaths.....	7,604	6,304	8,098
Outpatients, including rural clinics.....	446,235	673,389	866,673
Number of rural clinics.....	1,921	2,759	3,738
Major operations.....	994	1,410	1,586
Minor operations.....	6,091	4,746	4,724
X-ray examinations.....	750	1,326	1,636
Wassermann tests.....	9,733	11,234	11,661
Injections for treponematosi.....	229,481	378,749	550,946
Bed capacity.....			1,022

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington, D. C.
(For review.)

OLD AGE, THE MAJOR INVOLUTION, THE PHYSIOLOGY AND PATHOLOGY OF THE AGING PROCESS, by *Alfred Scott Warthin, Ph. D., M. D., LL. D., Professor of Pathology and Director of the Pathological Laboratories, University of Michigan.* Paul B. Hoeber, Inc., New York, 1929. Price, \$3

The Wesley M. Carpenter lecture of The New York Academy of Medicine was delivered by Doctor Warthin in October, 1928, under the title "The Pathology of the Aging Process." This aroused so much interest and discussion and the requests for published copies were so numerous that the author was persuaded to enlarge upon the subject matter and publish it in the form of this monograph.

Although many persons have expressed themselves as having been depressed by the philosophical conclusions inevitably deducible from the author's viewpoint, "just the opposite result was in his mind—the presentation of a rational workable philosophy of old age as an antidote to the modern futilities of life extension of the individual to extreme limits and of possible rejuvenation."

The opening and closing chapters make an appeal for a saner and more workable philosophy, one that is more in keeping with our present knowledge of biology and the physiology of senescence. In the first chapter—called "The Tragicomedy of Human Life"—the reader is reminded that, although we have advanced greatly in knowledge and philosophy since the time of Ponce de Leon, our judgment is so confused by our heart's desire that we are "made unhappy by any biologic philosophy of life which insists that age and death are evolutionary functions, necessary to the species, physiologic and inevitable, capable of alteration only through vast evolutionary periods."

Those who have learned to expect from Warthin something scholarly, profound, and yet pleasantly understandable and entertaining will not be disappointed in this book.

There is a brilliant chapter on "The Nature of the Human Machine," followed by chapters marked by high achievement in the excellence of description used in portraying the different biologic periods of human life.

In the chapter on "The Major Involution" there is a well-stated comparison of the critical periods of senescence and puberty. The entrance of senescence is for many a more critical period than that of puberty, because puberty, "whatever may happen, is still physiologically the age of optimism and ambitious hopes, while that of the climacteric is physiologically that of a psychical let down. Hence the dangers of disillusionment, depression, and discouragement as one faces the approach of senescence." One is given heart in the statement that "Fortunately, the cerebral functions have not yet completed their possibilities of development at the beginning of senescence, and these may continue an ascending curve for perhaps 20 or more years after the first signs of senescence, until senility is well established."

So many myths and tales have come to us about senile fatherhood and virility that it is good to find in the chapter on "Functional Changes in Senescence" something based on actual autopsy observations of the presence or absence of evidence of spermatogenesis in the testes at different ages. From Warthin's observations "it would seem probable that virility prolonged into the period of established senility has something of the pathologic about it." Much of clinical importance is found in the same chapter, showing what changes occur in lymphoid tissue, eyesight, hearing, digestion, circulation, urinary function, etc.

Under "Theories of Senescence" there is a brief but sufficiently comprehensive account of the views that have been advanced. The modern biologist, returning to the wisdom of Solomon and David, no longer can take seriously the ideas of Brown-Séquard, Metchnikoff, or Victor Horsley, whose explanations were pathologic. The modern view is strictly physiologic, the exact mechanism being the great problem. Weismann was the first to recognize in senility and death something that is part of the scheme of natural selection and of advantage to the species as a whole. The views of Minot, Childs, Loeb, Pearl, and Carrel are given.

Warthin shows very clearly the absurdity of the claims and statements made by the enthusiastic life extensionists, pointing out that the increase in longevity that has been brought about has been "through the prevention of extrinsic pathologic death in the earlier decades of life" and *not* through an "extension of the normal or

biologic life limit." An equally sound blow is dealt to the rejuvenationists, by showing that such procedures as the Voronoff or Steinach operation are at best (or worst) nothing more than a passing re-erotization. "The idea of physical rejuvenation is but a myth of ancient lineage disguised in quasi-scientific garments."

Much of comfort to the aged can be found in Warthin's philosophy of age. He closes the book with very apt quotations from Cicero, William Harvey, and finally Goethe: "Keine Kunst ist's, alt zu werden, Es ist Kunst, es zu ertragen."

HANDBOOK OF SURGICAL DIAGNOSIS, by *Clement E. Shattock, M. D., M. S. (Lond.)*, F. R. C. S. William Wood and Company, New York, 1929. Price, \$5.50

In reading over a book on surgery it is refreshing and stimulating to find one wherein the author limits himself to whatever particular aspect he is endeavoring to present. This is admirably done in the Handbook of Surgical Diagnosis. The book is all that it purports to be—a handbook "To present in a practical manner the differential diagnosis of the commoner surgical affections." It should be an invaluable aid to students first grasping clinical surgery, or to the general practitioner as a ready reference, but in addition, it will be found helpful to the surgeon in recalling some of the simple everyday details of differentiation lost in the mass of knowledge he must carry at all times.

The outline of approach to the subject and the presentation is excellent. The author states the condition to be considered, gives a brief, accurate description of the underlying pathology, when known, and then proceeds to a systematic yet simple differential diagnosis from similar conditions. There are many helpful suggestions about the physical signs and symptoms and how to elicit them. There are no suggestions as to treatment given; the author simply makes his differential point and goes on to the next subject. The style is fresh, brief, and very clear, so that reading is a joy rather than a chore. The index is accurate, but not extensive, although there are frequent cross references in the text which facilitate rapid finding of additional details. There occur occasional abbreviations such as W. R. for Wassermann reaction and G. S. W. for gunshot wounds, that are apt at first to be puzzling.

The subject matter seems to be accurate and up to date, even including roentgenograms of lipiodol injections to diagnose spinal cord tumors. The section on pathological conditions of bones and joints is especially good and there are numerous reproductions of excellent X rays.

The book is one for which there is an unquestioned need and it fulfills its function admirably.

WILLIAM HARVEY, by *Archibald Malloch, M. D. (McGill), M. R. C. P. (Lond.)*,
Librarian, New York Academy of Medicine. Paul B. Hoeber (Inc.), New
York, 1929. Price \$1.50

Those who feel the lure of medical history will welcome just now the biography of one whose three hundred and fiftieth anniversary was widely celebrated during the past year. Attention and interest in the history of our knowledge of the vascular system was further increased during 1928 in that the year marked the passing of another century of time since other notable events in the history of the physiology of the vascular system than the birth of William Harvey. Harvey's masterpiece on the movement of the heart and blood was published in 1628; Malpighi was born the same year; and John Hunter was born in 1728.

Doctor Malloch has chosen with skillful discrimination just the facts and events and quotations that one would want to learn and ought to know about the life and works of Harvey and which fit neatly into the pattern of this choice little sketch. If it was Malloch's design to arouse one's interest in the further reading of such fascinating subjects as the history of science and the biographies of its men, he has well succeeded.

Medical history like all history contains something much more solid and material than the entertainment supplied by the narrative. It furnishes a large basis for the interpretation and understanding of lives and events of our own day. Whether Malloch kept that point deliberately in mind or not can not be said, but certainly he has not escaped it.

How natural it would be to-day for a young man of Harvey's tastes and leanings and abilities to search out the finest fountain available—the trip to Padua was no small undertaking in Harvey's day, but it was accounted as nothing by him in his great search. Again, how natural to dissect everything he could lay his hands on; before he was 30 he had dissected carefully over 80 different species of animals, including his wife's parrot, this dissection revealing “that it was not a gentleman bird, as suspected, but a lady one.”

Like the true scientists of to-day Harvey did not rush into print with his views. The publication of the discovery of the circulation did not appear until 12 years after he was reasonably sure of the soundness of his theory. Osler, in his Harveian lecture of 1906, in considering this point, compares Harvey to Copernicus: “Perhaps it was the motive of Copernicus, who so dreaded the prejudices of mankind that for 30 years he is said to have detained in his closet the ‘Treatise on Revolutions.’” Harvey himself understood well enough the human failings in this regard. He lamented that “The crowd of foolish scribblers is scarcely less than the swarm of flies

in the height of summer, and threatens with their crude and flimsy productions to stifle us as with smoke."

Malloch disagrees with Harvey, who was charitable enough to think that if other anatomists had become familiar with the anatomy of lower animals they would have emerged from many difficulties and perplexities of doubt. Malloch knew that more than mere opportunity is required for the kind of discovery that Harvey made. He says "But surely he [Harvey] is more than charitable, for even if they had examined the lower animals, they would not have had Harvey's eye and brain!"

Harvey's apprehensions as to the reactions of others when he was announcing his discoveries are so like what many scientists under similar circumstances feel to-day, that a quotation can not be refrained from:

But what remains to be said upon the quantity and source of the blood which passes is so novel and unheard-of character that I not only fear injury to myself from the envy of a few but I tremble lest I have mankind at large for enemies, so much dost wont and custom, that become as another nature, and doctrine once sown and hath struck deep root and respect for antiquity influence all men. Still the die is cast, and my trust is in my love of truth and the candour that inheres in cultivated minds.

Harvey was, of course, limited by the lines beyond which the science of his time had not progressed, as we to-day are limited, for example, in the field of cancer research or in the study of ultra microscopic organisms. He realized these limitations and did not doubt "but that many things still lie hidden in Democritus's well that are destined to be drawn into the light by the indefatigable diligence of coming ages."

A true scientist, he approached his problem from every possible angle and was as exacting as Koch or Goldberger were in accepting nothing less than overwhelming evidence before being convinced that a certain view was correct and incontrovertible. The theory had to work backwards and forwards and fit every occasion and circumstance. The author has wisely included Huxley's observation that Harvey's work "contains the first application of quantitative considerations to a physiological problem" and reminds us of Lord Kelvin's view on the quantitative method in science:

Accurate and minute measurement seems to the nonscientific imagination a less lofty and dignified work than looking for something new. Yet nearly all the grandest discoveries of science have been the rewards of accurate measurement and patient, long-continued labor in the minute sifting of numerical results.

But even Harvey and equally keen minds sometimes get on a wrong track and are too obstinate to be brought back on to the

proper trail. He would not accept the view of Asseli, who discovered the lacteals of the mesentery in 1622. Of this error, Osler said:

How eminent soever a man may become in science, he is very apt to carry with him errors which were in vogue when he was young—errors that darken his understanding and make him incapable of accepting even the most obvious truths. It is a great consolation to know that even Harvey came within the range of this law—in the matter of the lymphatic system; it is the most human touch in his career.

THE INTERNATIONAL MEDICAL ANNUAL, 1929, by many contributors and editors. William Wood & Co., New York, 1929. Price, \$6

There is no other book in which abstracts of the year's worthwhile medical literature can be found so readily or in such complete form, and consequently there is no other source that will bring one's information so quickly and readily up to date.

Although all of the editors are British, it is interesting to note that they have chosen a large share of American current medical literature for their abstracts and comments.

This book has now reached its forty-seventh year of distinct success, and one of the features of this number is a photograph of the late Joseph Priestly (1859–1928) and a page devoted to the part he has played in compiling this annual for nearly 40 years. In 1892 he began writing the paragraphs on "Public Health and Medical Jurisprudence" that have been so prominent a feature of the volume ever since.

It would be difficult if not impossible to review critically or in detail the contents of the book, since the variety of subjects dealt with is enormous. It is virtually a dictionary of recent advances in medicine and surgery and all the specialties.

Much well-deserved space is given to the subject of radium therapy in cancer, since this has been one of the most important features in practice and literature during the past year.

The two great therapeutic discoveries of recent decades—insulin for diabetes and liver substances for pernicious anæmia—are further discussed. It appears that, unless the liver treatment is maintained, relapses are liable to occur, and the central nervous lesions of pernicious anæmia are generally not relieved, though some observers report success. For the malarial treatment of dementia paralytica it is claimed that a substantial remission of symptoms is secured in many cases; but the liver is appreciably damaged in the process, and there are other drawbacks.

An interesting list of very diverse substances and processes of manufacture which are alike in their capacity for exciting dermatitis—iodized oil, linseed oil, chromium plating, stages in the making of rubber, horn-rimmed spectacles, quinine suppositories—serves to

remind us that new times bring not only new customs but also new diseases. Possibly carcinoma of the lung is on the increase, and it is even suggested that some of the so-called mediastinal lymphosarcomata are really carcinomata arising from the bronchi.

Col. L. W. Harrison has edited the section on gonorrhea and gives a clear account of the recent outstanding advances in treatment. He describes the local urethral applications of acriflavine in the medium of solid gelatin, which R. D. Herrold and H. Culver, working independently, found to be of advantage, as the antiseptic can be used in much greater strength by this method than in aqueous solution. He speaks encouragingly of the new drug, citrogan, produced by Kissmeyer and Andreson (Copenhagen). Under treatment of epididymitis he commends the bandage and suspensory described by M. F. Campbell in the *Annals of Surgery* of October, 1927.

Colonel Harrison has edited also the section on syphilis, and here writes forcibly on the importance of experimental syphilis in animals as a source of information on the problems of human syphilis. He says, in part:

So far as they have gone at present, animal experiments seem to teach us, among other things, that syphilitic infection is latent from the first in a definite proportion of cases, so that nonappearance of a primary lesion is poor evidence of noninfection; that lymph glands are the principal harborers of the virus in latent syphilis, and that, in the absence of therapeutic measures, these remain virulent throughout the life of the animal; that the Neisserian dictum that a new infection with syphilis is impossible until the original infection has been eradicated is incorrect; that failure to reinfect does not prove failure to eradicate the original attack; that immunity resulting from interaction of parasite and tissues may be only partial and confined to the skin only; that immunity against reinfection with the strain of *Sp. pallida* originally employed may be ineffective against a heterologous strain; that many fever-producing agencies, though they ameliorate the processes of syphilis, do not eradicate it; and that, in treatment by such remedies as bismuth, it is necessary to use such a preparation in such a dosage as will result in a given minimal amount of the metal being incorporated in the tissues.

AN INTRODUCTION TO THE STUDY OF PHYSIC. by *William Heberden (1710-1801)*.

A prefatory essay by *Leroy Crummer*. Paul B. Hoeber, New York, 1929

There are several reasons why this handsome little volume should constitute a highly prized addition to any library of medical history.

The original manuscript was recently unearthed by Doctor Crummer during a visit to a small second-hand bookshop in London, and much to his delight it was found to be not only genuine but hitherto unpublished. The Heberden bibliography is not large, and this newly discovered addition will be warmly welcomed by the historians.

Book lovers are lovers of fine printing, and they will experience a large measure of satisfaction in possessing a book of this sort hav-

ing the prefatory essay by Doctor Crummer, in which he displays his widely known talent as medical historian, and the eminently superior printing which distinguishes the Hoeber publications of medical history.

The prefatory essay is a fascinating account of the life and times of Heberden, and deals especially with Heberden's writings and his associates.

Following the essay is a list of the Heberden bibliography and a check list of Heberden manuscripts.

Little need be said about the "Study of Physic" except to observe that it is a genuine classic and illustrates the medical thought of Heberden's time.

The "Account of a Disorder of the Breast" shows Heberden's descriptive powers in his portrayal of the symptoms of *agina pectoris*.

THE NOSE, THROAT, AND EAR AND THEIR DISEASES. In original contributions by American and European authors. Edited by *Chevalier Jackson, M. D., Sc. D., LL. D., F. A. C. S., Professor of Bronchoscopy and Esophagoscopy in the University of Pennsylvania, in the Jefferson Medical College, and in the Graduate School of Medicine of the University of Pennsylvania; Lecturer on Bronchoscopy and Esophagoscopy in the Woman's Medical College of Pennsylvania and in Temple University, Philadelphia, and George Morrison Coates, A. B., M. D., F. A. C. S., Professor of Otology, University of Pennsylvania Graduate School of Medicine.* W. B. Saunders Co., Philadelphia, 1929

It is impossible to review a book of nearly 1,200 pages compiled from the contributions of 75 authors except to call attention to the enormous scope and content of the book. It is unquestionably the last word among books which attempt to cover this field in a thorough and comprehensive manner.

The index alone occupies 30 pages, and is, of course, of great value as a reference to a large part of the world's most authoritative opinion in this field. Certain subjects are in many cases considered by two or more authors from very different points of view.

While every conceivable phase of the disorders of these organs is covered in great detail, a relatively large part of the book is given over quite naturally to the subjects of laryngoscopy, bronchoscopy, and esophagoscopy because of Doctor Jackson's well-known interest and achievements in such work.

THE TONSILS AND ADENOIDS AND THEIR DISEASES, by *Irwin Moore, M. B., C. M. (Edin.), Late Honorary Surgeon to the London Throat Hospital for Diseases of Throat, Nose, and Ear, Great Portland Street, and also to the Hospital For Diseases of the Throat, Golden Square, London, W.* The C. V. Mosby Co., St. Louis, 1928

This book will no doubt be greatly welcomed by both mature and young otolaryngologists, since it embodies, in addition to an exhaustive review of the literature, the extensive experiences of the author

in regard to the relation of the tonsils and adenoids to general diseases.

Enough space is devoted to the regional anatomy to give an intelligent appreciation of the pathology and surgery of the tonsils and adenoids, and the book should serve well as a comprehensive guide to the busy practitioner and as a valuable reference for the otolaryngologist.

The review of experiences of many leading authorities on both continents is especially complete and instructive in regard to pulmonary complications following tonsillectomy.

It is evident that the question of hemorrhage during and following tonsillectomy is a matter of very great concern to the author. He deplores the casual way in which tonsillectomies are often performed with small attention paid to the important matter of hemostasis. The chapter on hemorrhage and its control is 70 pages long and is truly a most admirable monograph on the subject.

Of particular value as to reference is the chapter dealing with the problem presented by cases in which surgical procedures are contra-indicated. In this connection the author speaks highly of the method of "London paste" applications. The technique for the preparation and application of this paste is given in full. It is made of sodium hydroxide, slaked lime, and alcohol. This paste was introduced in 1864 by Morell Mackenzie (to the memory of whom this book is dedicated) and has many advantages over the "Vienna paste" described by Fournié in 1863.

INTERNATIONAL CLINICS, A QUARTERLY OF ILLUSTRATED CLINICAL LECTURES AND ORIGINAL ARTICLES. VOLUMES I AND II, THIRTY-NINTH SERIES, 1929. J. B. Lippincott Co., Philadelphia, 1929

In volume 1 the first three chapters are from the clinics of Lewellys F. Barker. Doctor Barker, as usual, has prepared these papers in a masterful fashion, and the reader is quickly impressed with the rare excellence, clinical and literary, displayed in them. In the first paper he presents a case showing a bizarre syndrome resulting from lesions in the globus pallidus, substantia nigra and thalamus.

In his clinic, in which he presents a case of cirrhosis hepatitis, he discusses in an illuminating way the psychopathic reactions produced by alcohol and closes with a brilliant dissertation on the subject of prohibition.

S. R. Roberts has contributed a classical description of pellagra in an article called "Pellagra of To-day" and gives an excellent discussion of the present day views of the etiology as worked out by Goldberger and his associates. "Dermatitis, diarrhea, and depression sum it clinically," he says, and "poverty, ignorance, and neglect sum it economically and socially."

Col. C. F. Craig furnishes a valuable amount of the latest information in his paper on "The Diagnosis and Treatment of Latent Amœbic Infection."

In the last chapter of Volume I, Col. J. A. Coupal presents a most interesting summary of the "Progress of Medicine in 1928."

In Volume II, A. H. Gordon gives the reader in a few pages a unique and forceful account of his idea of the rational treatment of pneumonia. He stresses the importance of absolute rest, and in speaking against the practice of too frequent bathing, changing of linen and taking of temperatures, says, "a bed sore is bad but a corpse is worse." He believes that great danger comes from "those whom Dr. John Hay aptly, though irreverently, calls 'Gawdsakers'; those who demand 'action'; 'let's get something going'; 'for Gawdsake, Doctor, can't you *do* something?'" He also decries the undue use of purgatives because of their weakening effect.

As renal conditions have been shown increasingly to be responsible for many gastrointestinal symptoms, the chapter by Jonathan Forman on this subject will be of interest to those confronted with the problem of eliminating urinary tract disorders as possible causes of these symptoms in certain cases.

DISEASES OF THE THYROID GLAND, by *Arthur E. Hertzler, M. D.*, with a chapter on Hospital Management of Goiter Patients, by *Victor E. Chesky, M. D.* Second edition. C. V. Mosby Co., St. Louis, 1929. Price, \$7.50

This is a complete monograph covering the entire subject of the thyroid gland, including etiology, gross and microscopical anatomy and pathology, symptomatology, classification, medical and surgical treatment, with a chapter on hospital care.

It is admirably printed and fully illustrated with excellent photographs and diagrammatic cuts, presenting histological and pathological material and especially anatomy, and the steps of surgical technique.

The text is well arranged and the author's style is agreeable. Description and narrative are clear, definite and complete without elaboration and one gains a most comprehensive and satisfactory grasp of the subject. To the mind of the reviewer this is an excellent work on the subject.

RECENT ADVANCES IN NEUROLOGY, by *W. Russell Brain, M. A., D. M. (Oxon.)*, *M. R. C. P. (London)*, Assistant Physician to the London Hospital; Assistant Physician to the Hospital for Epilepsy and Paralysis, etc.; and by *E. B. Strauss, B. A., B. M., B. Ch. (Oxon.)*, *M. R. C. P. (London)*, Medical Registrar to the Hospital for Epilepsy and Paralysis, Maida Vale, etc. P. Blakiston's Son & Co., Philadelphia, 1929

This is a compact and convenient little handbook, containing 412 pages, and belongs to The Recent Advances Series. It is not in any

sense a formal textbook of neurology, but selects from the mass of recent research the clinical and applied material for the benefit of the qualified student reading in that field. It has been the authors' object "to collect and collate the most important neurological contributions of recent years and to treat our material in such a way that fundamental principles emerge from a wealth of detail."

Ayer's cisterna puncture is briefly discussed; in fact, too briefly, for those who are not already acquainted with the literature and technique of this important diagnostic and therapeutic procedure.

There is an excellent discussion of encephalitis lethargica. The importance of this condition is obvious when it is realized that over 6,000 published articles have appeared since Von Economo's monograph on the subject in 1917 (Vienna). In chronic or post-encephalitic conditions such as Parkinsonism no mention is made of foreign protein therapy or the method of Piticarou. The objective in the latter method is the production of autoimmune bodies by the intravenous injection of the patient's own spinal fluid, thus striking at the chronic infectious nature of such conditions.

Throughout the book considerable emphasis is placed on methods of treatment, and this feature is especially to be commended. A chapter is devoted to the physiological action of hypertonic solutions on increased intracranial pressure. The practical use of such a simple measure as the intravenous injection of 200 c. c. 50 per cent glucose solution in normal saline is obvious in the treatment of head injuries, etc. The three last chapters deal entirely with a consideration of treatment in neurological conditions, including the malarial treatment of general paresis and the ketogenic diet in epilepsy.

This little volume is excellent auxiliary and supplementary reading to the standard textbooks in neurology. There are frequent references to American contributors and the names of Cushing and Dandy recur many times. Other names famous in neurology are noted in the references such as Frazier, Fay, Ayer, Starling, Sherrington, Holmes, Head, S. A. K. Wilson, Pavlov, and Babinski, and their recent contributions and work is adequately summarized.

RECENT ADVANCES IN PSYCHIATRY, by *Henry Devine, O. B. E., M. D., B. S. (Lond.), M. D. (Bristol), F. R. C. P. (Lond.), Medical superintendent, Holloway Sanatorium, Virgin Water; lecturer on Psychology, Maudsley Neurological Hospital; late Examiner in Psychology for Diploma in Psychological Medicine, Royal College of Physicians; late Consulting Neurologist, Royal Victoria Hospital, Netley; late Medical Superintendent, Portsmouth City Mental Hospital.* P. Blakiston's Son & Co., Philadelphia, 1929

This is one of a series of books dealing with recent advances in the different branches of medicine and in this particular volume represents an effort to collect, correlate, and comment upon abstracts from recent literature dealing with psychiatry. Naturally, the bib-

liography is very important, and in this book the references are conveniently arranged at the end of each chapter and are complete and exhaustive.

In addition to an introduction, the subject matter of the book is divided into five main parts, the headings of which, in order, are (I) toxic, infective, and somatic factors in the causation of psychoses; (II) the effects of somatic disease in psychotic subjects; (III) the behavior of the organism in mental disorders; (IV) biopsychic types; and (V) psychology and the psychoses.

In the introduction the author states that "it may be said at the outset that one of the greatest advances in psychiatry is an appreciation of the fact that the term 'insanity' only covers a small proportion of 'mental,' 'conduct,' or 'behavior' disorders. * * * Thus, under the heading of behavior disorders are now included much more than the certifiable psychoses; and the appreciation of the fact that many individuals formerly stigmatized as delinquent, difficult, or disagreeable are actually the subjects of recognizable psychopathic syndromes in itself marks an advance in psychiatric knowledge."

Although the book presents nothing of proven value and infallible in the prevention and cure of the psychoses, it is interesting in that it presents in an orderly manner the scientific progress that is being made toward that end. Under the discussion of the part played by chronic infections in mental disorders he quotes fully from the experience of Cotton. In a consideration of the biogenetic psychoses he lists the heredity tables of Kretschner. A description of the Wagner-Juaregg method for the malarial inoculation treatment of general paresis is given in detail. A very clear exposition of Freud's and Adler's theories of neurosis formation is given. There is also an interesting chapter on the relationship of physique to the psychological type. In considering basal metabolism in the psychoses he notes that Walker observes that the lower basal metabolism in the majority of cases of dementia præcox is another way of stating that there is a diminution of oxidation processes within the body.

On the whole the book has a definite value for students of psychiatry.

RECENT ADVANCES IN BACTERIOLOGY AND THE STUDY OF THE INFECTIONS. by J. Henry Dible, M. D., M. R. C. P., Professor of Pathology and Bacteriology in the Welsh National Medical School; Late Professor of Pathology in the University of London. P. Blakiston's Son & Co., Philadelphia, 1929. Price \$3.50

The writer has succeeded admirably in presenting in a readable form the advances in bacteriology during the last 15 years and in giving a well-balanced discussion of work which is still on trial.

The first chapter gives the bacterial classification of the Society of American Bacteriologists. The author believes this classification is gradually coming into current usage. The other chapters deal with the following: The streptococcus problem; bacterial variation; the bacteriophage; experimental epidemiology; Calmette and B. C. G.; ultramicroscopic and filter-passing viruses; diseases associated with rickettsia bodies; measles; tularemia; recent work upon the pneumococci; recent work upon spirochaetal infections; local immunity and the work of Besredka; recent work in connection with diphtheria; recent work upon the anaerobic organisms.

PATHOLOGY FOR STUDENTS AND PRACTITIONERS, by *Edward Kaufmann, M. D., Professor of General Pathology and Pathological Anatomy and Director of the Pathological Department, University of Göttingen.* Translated by *Stanley P. Reimann, M. D., Pathologist and Director of the Research Institute of the Lankenau Hospital, Philadelphia; Assistant Professor of Experimental Pathology in the Graduate School of the University of Pennsylvania.* Volumes I, II, and III. P. Blakiston's Sons & Co., Philadelphia, 1929. Price \$30

By placing a translation of Kaufmann's *Lehrbuch der Pathologischen Anatomie* in the hands of the English-reading practitioners and pathologists, Doctor Reimann is deserving of great credit. He, likewise, merits praise in enhancing the value of the text by his own instructive contributions, which include material of interest to American readers on tularemia and Rocky Mountain spotted fever; also by the addition of more than 100 excellent illustrations.

This text, now in its eighth German edition, has long been a standard work. It is in three large volumes with 1,072 illustrations. In this massive presentation of pathological conditions both author and translator have endeavored to emphasize the relationship of pathology to the sick by numerous references to clinical data.

The text deals primarily with special pathology for this reason, and because of its size it would seem to be of greater value as a work of reference than as a textbook for students. Readers desiring more information on a subject will find in the third volume an amazingly exhaustive bibliography of the world's literature.

SURGICAL PATHOLOGY, by *William Boyd, M. D., Professor of Pathology, University of Manitoba, Winnipeg, Canada.* Second Edition. W. B. Saunders Co., Philadelphia, 1929. Price, \$11

This excellent book in its second edition has been thoroughly revised and brought up to date. Many new illustrations have been added and about twenty of the older figures replaced by newer ones, some of which are X-ray photographs.

In a foreword Dr. Wm. Mayo says:

What is needed to-day in the literature of surgical pathology is a work that will serve as a handbook to the surgeon and the internist and a guide to the

beginner in the field of medicine. Doctor Boyd has made an earnest effort to fill this need.

Amongst the wealth of new material is the interesting work of Doctor Cadham, of the Winnipeg General Hospital, on the treatment of streptococcal septicemia by injecting the organisms obtained by blood culture into a rabbit and obtaining in the course of six days a serum that has given quite remarkable results. This serum has the advantage over stock serum of being both autogenous and containing active complement.

The chapters dealing with gastric and duodenal ulcers, goitre, the breast, the liver and gall bladder, and other important organs and conditions that are of great interest to the surgeon and internist are fully developed and especially instructive.

A short list of references for further study are given at the end of each chapter.

This book is very readable and the style is delightful. It is heartily recommended to student, surgeon, internist, and pathologist alike.

SURGICAL PATHOLOGY, by Cecil P. G. Wakeley, F. R. C. S., (Eng.), F. R. S., (Edin.), Hunterian Professor, Royal College of Surgeons of England; Junior Surgeon, King's College Hospital; Assistant Surgeon, Belgrave Hospital for Children and West End Hospital for Nervous Diseases, etc. William Wood & Co., New York, 1929. Price, \$12.50

The authors have endeavored to trace the pathology of each surgical disease from its inception and to illustrate the condition as far as possible. They advise the student to study gross specimens while reading the text.

The book includes a very great number of surgical conditions and the arrangement is very suitable for teaching purposes. Prominence is given to the theory most generally accepted rather than a detailed consideration of unproven or conflicting theories of pathogenesis. The orthopedic conditions are given considerable space and illustrated with radiograms.

The binding, paper, and printing are excellent. There is no bibliography. The style is good and the illustrations are for the most part well selected and numerous.

PROTOZOOLOGY, by John Gordon Thomson, M. A., M. B., Ch. B., Director, Department of Protozoology, London School of Hygiene and Tropical Medical Medicine, and Andrew Robertson, M. B., Ch. B., Lecturer and Milner Research Fellow in the Department of Protozoology, London School of Hygiene and Tropical Medicine. William Wood & Co., New York. Price, \$11

A manual of the protozoal parasites, which shows considerable experience on the part of the authors in teaching protozoology to medical men, particularly those who intend to engage in the practice of medicine in the Tropics.

This is well demonstrated by the arrangement with which the various protozoa are taken up, the succinct but ample descriptions of their morphology and life histories, and particularly the including of the gross and histopathology caused by these parasites, which latter links up the organism with the clinical phase of the subject.

The text throughout shows that all the recent advances which have been made in tropical medicine as pertain to the protozoal diseases have been carefully considered. With references and with topics of doubtful nature the reviewer has been impressed with the fairness of the authors' presentation.

The protozoa in animals and objects in the blood, feces, dark field, etc., which may be confused with human protozoa, are appropriately described. The authors are quite right in their statement to the effect that few textbooks draw attention to artefacts of puzzling nature and that mistakes are continually made as a result of such confusing bodies.

The work is unusually well illustrated. The majority of the drawings and photomicrographs are original, represent considerable effort, and show care in selection.

Although this manual was intended essentially for students taking a course in tropical medicine, the wealth of practical data it contains makes it a valuable addition to the library of the instructor of medical zoology.

MANUAL OF HELMINTHOLOGY, by *H. A. Baylis, M. A., D. Sc., Assistant Keeper, Department of Zoology, British Museum.* William Wood & Co., New York, 1929. Price \$10

This work consists of a brief description of the morphology, occurrence, and the more important facts in the life history of each genus and species of worms which immediately concern man and the common domestic animals.

The author has been unusually successful in his aim to be as brief and concise as possible in presenting this phase of helminthology, which, although a small part of the subject, ordinarily calls for a much larger work.

The illustrations are ample and instructive, an invaluable feature to a text of this nature.

The index classifying the various worms according to their animal hosts, which concludes the subject material, is likewise a valuable and handy reference for a worker in helminthology.

Another commendable feature, particularly in view of the universal interest in the uniformity of zoological names, is the author's use of names in accordance with rules of the International Commission on Zoological Nomenclature.

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This attempt to bring together under one cover a description of the numerous species of worms parasitic in man and in the animals man ordinarily comes in contact with, many of which require a search through a mass of scattered literature, will be appreciated by those interested in medical or veterinary helminthology.

IMPERATIVE TRAUMATIC SURGERY, by *C. R. G. Forrester, M. D., F. A. C. S.*, New York: Paul B. Hoeber (Inc.), New York, 1929. Price, \$10

The author gives the treatment he uses and the prognosis he expects for each type of injury discussed. Visceral injuries and injuries to tendons, muscles, vessels, and joints are given only a passing attention, but fractures and peripheral nerve injuries are fully dealt with. Most textbooks which describe several methods of treatment for a single lesion leave all but the expert in the special field a bit confused as to which method to adopt in a particular case. The author's method of presentation is of advantage to the beginner in traumatic surgery and of especial value to the physician who is only occasionally called upon to assume full responsibility for injured persons. To the naval surgeon who must occasionally assume full responsibility for a fractured humerus, femur, or spine this book is an excellent guide to diagnosis and practice. To carry out correct procedure within the first few hours after trauma has been received, to give the patient and the employee a correct prognosis as to time and final result one must have wide experience or expert consultation. In this book one receives the advantage of the author's consultation advice in terms that are understandable. When wide experience or expert consultation are not available this book is the next best protection available to the patient and to physician.

THE GENESIS OF EPIDEMICS AND THE NATURAL HISTORY OF DISEASE, by *Clifford Allchin Gill, Lieutenant Colonel, Indian Medical Service*. William Wood & Co., New York, 1928. Price \$7.50

Following the disastrous malaria epidemic of 1908, the Government of India the following year decided to create a special organization for the study of this disease. The author began the study of malaria in the Punjab in 1913, and, with the exception of the period of the World War, continued this work until April, 1923. It became necessary to study the epidemiology of other diseases in the early part of his observations and it was during the course of these subsidiary investigations that the remarkable similarity of all epidemic phenomena first became noticeable. He advances the quantum theory which assumes that the principles applicable in the case of the individual also apply in the case of the community. The theory thus purports to explain all epidemical phenomena in terms

of a change in the relationship between the "infection" quantum and the "immunity" quantum, whereby either a sudden increase of infection occurs at a time when immunity is absolutely and relatively low, or a sudden decline of immunity is associated with a relatively constant degree of infection. A sudden depression of communal immunity is less likely to occur than a sudden increase in the amount of infection, and it is consequently held that circumstances conducive to a sudden increase of the infection quantum play a predominant part in determining epidemic explosions. A diagram indicates the endemic and epidemic status of communities. A condition of hyperendemicity is produced when the infection and immunity factors are constant and high. Endemicity is referred to when these factors are constant but low. Equilibrium is readily maintained and mild endemic disease is unassociated with liability to epidemic explosions. The preepidemic status prevails when infection has been interrupted and immunity absent. There is no sickness owing to the low infection quantum. With the reestablishment of infection however the epidemic status results. As the epidemic wanes, infection and immunity both become high and the postepidemic status ensues. The interepidemic status is characterized by another prolonged period in which infection is interrupted and during which the immunity quantum gradually declines until the preepidemic status is again established.

The author reviews recent epidemics in the Punjab of malaria, influenza, and plague, two of which are insect and one air borne, applies his quantum theory, and finds that the data support this theory in every case. He remarks that the occurrence of qualitative changes in specific parasites in the direction of exalted virulence, apart altogether from any association with epidemics, does not appear to be entirely free from doubt, and offers the surmise that the "prolificity" of a microorganism under natural conditions may be indicative of its power of multiplication in a favorable environment. Hence, it is possible that "prolificity" may represent a quantitative rather than a qualitative change of the specific parasite. It is thought that the enhanced diffusibility exhibited by disease in epidemic form is fully explicable in terms of the quantum theory and that it is unnecessary to assume that a new strain of virus or the biological modification of the specific parasite plays any part in determining the spread of epidemics.

Considerable importance is attached to atmospheric conditions. It would appear, he states, that epidemic diseases may be divided into two classes in accordance with the conditions determining their transmission—those, such as influenza, pneumonic plague, and typhus, in which low temperature and low saturation deficiency are favorable to infection; and those, such as malaria and bubonic plague, whose

transmission requires the presence of relatively high temperature in association with low saturation deficiency.

In regard to certain deficiency diseases he states it must, in fact, be concluded that epidemics of disease invariably represent the response of the community to a parasitic invasion, which thus implies that a living organism is concerned in the mechanism of all epidemics including some, such as pellagra, beri-beri, epidemic dropsy, and epidemic goitre, in which avitaminosis is now held to be the predominant, if not the sole, causative factor.

In summing up the author holds that the quantum theory has established a strong claim to be regarded as affording an adequate explanation of the genesis of epidemics, and as representing a fundamental law. Endemical phenomena appear to represent a state of affairs in which man and his parasites are completely adapted to their environment, whilst epidemical phenomena constitute the expression of a partial or incomplete adjustment.

A well-written and very readable book. Recommended to all medical officers interested in epidemiology or preventive medicine.

MANSON'S TROPICAL DISEASES, by *Philip H. Manson-Bahr*. Ninth edition. Wm. Wood & Co., New York, 1929. Price, \$11

The first edition of this book appeared in 1898. One of the first books of its kind to appear in English, it filled a long-felt need and immediately attained a high degree of popularity among medical men interested in diseases of the Tropics. It has become one of the best-known manuals of its kind. It was first revised in 1900. The sixth edition was the last to be edited by Sir Patrick Manson. The seventh and subsequent editions have been edited by Dr. Manson Bahr, of the London School of Tropical Medicine.

The general arrangement and the treatment of the subject matter remains essentially the same as in previous editions. Changes pointing out recent advances in tropical medicine, particularly along the lines of treatment, have been made where necessary.

The chapter on yellow fever has been rewritten and gives the latest views relative to that disease. The section covering the dysenteries, cholera, sprue, and tropical liver is complete and embodies much personal experience of the editor.

In the chapter on pellagra it is thought that the work of Goldberger and his associates has not been given sufficient weight.

The appendix consists of two sections, one devoted to medical zoology, the other to laboratory methods.

For practitioners in the Tropics, students, and the profession generally the book will undoubtedly continue to be among the best books available on the subject.

SURGERY IN THE TROPICS, by *Sir Frank Powell Connor*. P. Blakiston's Sons & Co., Philadelphia, 1929

This little volume might well have been entitled, "Tropical Diseases written by a Surgeon Practicing in the Tropics." The author does not give operative technique in detail except in such conditions as liver abscess and filarial elephantiasis. He stresses the surgical treatment indicated for the tropical diseases he describes and takes up those diseases which have a direct surgical aspect as well as those conditions which often complicate the post-operative care of patients operated upon in countries where the dysenteries, intestinal parasites, malaria, yaws, leishmaniasis, etc., are prevalent. One should not turn to this book to learn the art of surgery. The surgeon who has begun to practice his art in temperate climes and then transfers to the Tropics will find in this book much to help him to become more quickly orientated to his new environment.

PHYSICAL THERAPEUTIC TECHNIC, by *Frank Butler Granger, A. B., M. D., Late Physician in Chief, Department of Physical Therapeutics, Boston City Hospital; Director of Physiotherapy, United States Army; Medical Counselor, United States Veterans' Bureau; Member of Council on Physical Therapy, American Medical Association; Instructor of Physical Therapeutics, Harvard Medical School; Assistant Professor of Physical Therapy, Tufts Medical School; Past President American Academy of Physiotherapy*. W. B. Saunders Co., Philadelphia, 1929

This book is one of the most comprehensive yet seen on the subject and deals with many methods of treatment which ordinarily have not been considered in the past as belonging to the field of the physiotherapist.

This reviewer shares heartily the opinions of William D. McFee, who says in the foreward, "The information contained has an extensive clinical background and it should be of tremendous help to the beginner as well as of great interest to those already familiar with the work of physical therapy."

The greater part of the book (the first 10 chapters) is devoted to electrical forms of treatment.

A most useful chapter, which is an outline synopsis for teaching physiotherapy, has been contributed by Frank A. Davis, this being the outline employed by him at the school of neuropsychiatry of the Veterans' Bureau.

Those interested in the installation of physiotherapy equipment at hospitals will find much valuable information in a chapter called "A Hospital Department of Physical Therapy," which is reprinted from the Journal of the American Medical Association of March 12, 1927.

Those who have suffered from calcified subdeltoid bursitis or who have occasion to treat this very common and very agonizing condition will find much encouragement in the author's chapter on its treatment.

PHYSIO-THERAPY IN GENERAL PRACTICE, by *E. Bellis Clayton, M. B., B. Ch. (Cantab.)*, *Director of the Physio-Therapeutic Department, and in charge of the Massage and Electrical School, King's College Hospital, London.* Second edition. William Wood & Co., New York, 1929. Price, \$3.50

This book has been written for the general practitioner and the masseuse.

The treatments described and principles discussed are those in use at King's College Hospital.

Two chapters are devoted to descriptions and explanations of the different forms of massage, exercises, and electrical and light treatment. The rest of the book is divided into the different types of ailments, with the physical therapeutic measures indicated in each of these disorders.

The general arrangement of the book is excellent. There is no waste of words nor extravagant statements or claims. The author tells clearly and simply what may be expected from these physical measures in the way of results.

The general practitioner will find in the treatments for injuries, fractures, and deformities many suggestions which are most practical and sensible and which meet with the approval of the best orthopedic opinion to-day.

The value of measures recommended in the treatment of cardiac and respiratory diseases is not so obvious, while those described for such conditions as fibrositis and rheumatoid arthritis remind one that much can be done for these conditions which often fail to receive these distinctly beneficial treatments.

THE CONQUEST OF CANCER BY RADIUM AND OTHER METHODS, by *Daniel Thomas Quigley, M. D., F. A. C. S.*, *Instructor in Surgery in the University of Nebraska College of Medicine; Fellow of the American Medical Association; Member of the American Association for the Advancement of Science, Nebraska Academy of Sciences, North American Radiological Society, American Radium Society; Fellow of the American College of Radiology; Director of the Radium Hospital of Omaha.* F. A. Davis Co., Philadelphia, 1929. Price, \$6

Every bit of this book makes excellent reading, and it would be difficult to find in any other book of medium size so much of the sort of information most of us desire in regard to the cancer question.

The introduction is intensely interesting and contains a clear account of the alarming increase of incidence of malignant diseases and the extension of cancer into what was formerly considered the

precancerous age period. The author has traced in the introduction the high points in the history of cancer both from the standpoint of theories as to etiology and as to progress made in the field of treatment. This he has done in a manner which shows him to be as accomplished a medical historian as a clinician.

The book is divided into four sections: Causation and prophylaxis; treatment; a summary of present day knowledge of cancer; diseased conditions other than cancer in which radium is of value.

HISTORY OF BLOCKLEY, A HISTORY OF THE PHILADELPHIA GENERAL HOSPITAL FROM ITS INCEPTION, 1738-1928; compiled by *John Welsh Croskey, M. D. F. A.* Davis Co., Philadelphia, 1929. Price, \$10

To those who have served at Blockley, or to those who know the institution at all, this book should prove an historical work of great interest. But even if one does not know Blockley, he will find in this book enough of medical biographies and enough of the story of the development of medicine in America to make the reading quite worth while.

The story goes back to a date of more than 200 years ago when William Penn organized the Society of Friends, which later built the predecessor of Blockley, the Quaker Almshouse of Philadelphia.

Philadelphia physicians may feel justly proud that in their city was started the first hospital in the United States; also that the first medical textbook printed in America, and the first medical lecture delivered in America are events that belong to Philadelphia.

Dr. D. Hayes Agnew writes entertainingly of the part Blockley played in the medical history of the Revolutionary War and of the yellow-fever epidemic of 1793.

J. Chalmers DaCosta has contributed a chapter on the early days at Blockley that he knew and describes with rich humor the politicians who were guardians of the poor at Blockley. Among the many attributes of the Blockley politician as described by DaCosta, "he was from 5 feet 6 to 6 feet 10 high and from 10,000 to 20,000 dollars short."

Among the biographies may be mentioned those of John Rhea Barton, William Paul Crillon Barton (first Surgeon General of the Navy), Thomas Canby Craig (naval medical officer, 1880-1898), Jacob Mendez DaCosta, Samuel D. Gross, Elisha Kent Kane, Silas Weir Mitchell, John H. Musser, William Osler, F. H. Packard, Joseph Pancoast, William Pepper, Benjamin Rush, and H. W. Stelwagon.

CLINICAL ELECTROCARDIOGRAMS, THEIR INTERPRETATION AND SIGNIFICANCE, by *Frederick A. Willius, M. D.* W. B. Saunders Co., Philadelphia, 1929. Price, \$8

The entire book is presented in a thorough graphic manner. The illustrations, of which there are 368, are clearly explained, and one

can interpret the findings of these records and their clinical significance without reference to the text. In addition to the illustrations there is a well-prepared bibliography after each chapter.

It is significant that the author maintains that the science of electrocardiography should be emphasized in clinical medicine only as an adjunct to other clinical methods of diagnosis.

A very interesting section of the book is the demonstration of the prognostic value of significant T-wave negativity by the use of tables which show the associated cardiac mortality.

By a study of these graphic records a clear conception of the cardiac arrhythmias and their significance can be obtained. It is believed that this book should be a part of the library of the medical officer interested in cardiology.

PRINCIPLES AND PRACTICE OF ELECTROCARDIOGRAPHY, by *Carl J. Wiggers, M. D., Professor of Physiology in the School of Medicine of Western Reserve University, Cleveland, Ohio.* C. V. Mosby Co., St. Louis, 1929. Price \$7.50

This exceedingly valuable contribution to the literature on electrocardiography is dedicated to the memory of Willem F. Einthoven, of whom a splendid photograph appears opposite the title page.

The first half of the book is devoted to the physics and mechanics of the electrocardiographic equipment, including detailed descriptions and discussions of the different makes of electrocardiographs.

The second half deals with electrocardiograms, the physical and physiological causes of electrocardiographic deflections, and the interpretation of these deflections as seen in the electrocardiograms.

DIAGNOSTIC METHODS AND INTERPRETATIONS IN INTERNAL MEDICINE, by *Samuel A. Loewenberg, M. D., F. A. C. P., Assistant Professor Clinical Medicine, Jefferson Medical College; Assistant Physician to the Jefferson Hospital; Visiting Physician to the Philadelphia General Hospital, the Northern Liberties Hospital, and the Eagleville Sanatorium for Consumptives; Formerly Assistant Professor of Physical Diagnosis at the University of Pennsylvania, Philadelphia.* F. A. Davis Co., Philadelphia, 1929

The author states in his preface that he has ventured to compile a textbook of general information upon medical diagnosis from the standpoint of the rapidly disappearing "general practitioner." On the whole, he has accomplished his purpose. The book contains a mass of information well arranged and readable. The first half, which is devoted to history taking, general physical examination, laboratory investigation, and regional study, is the best in the book and is well worth reading. It is a pleasure to read the diagnostic methods of examination of the respiratory and cardio vascular system, and the author is to be commended on this section.

The chapter dealing with electrocardiography contains mistakes which will make it difficult for the student to read this section and understand the normal. This statement occurs on page 489: "The

R wave *may* occur in front of the T wave." Also on page 490: "It (the P R interval) measures from 0.12 to 0.18 of a second from where the T wave first leaves the base line to where the R wave begins."

The chapter on the endocrine system is entirely too brief, and much of this limited space is devoted to those signs of little value in diagnosis of border-line cases. As an example, approximately two pages are devoted to exophthalmic goiter and of this nearly all is taken up with a detailed description of the various eye signs, the Kottman reaction, and Goetsch test, while all other symptoms and diagnostic signs are tabulated without giving methods of demonstrating them or an explanation as to their clinical value. One would gain the impression that this condition could be diagnosed by the eye signs alone, and that they were by far the most important signs instead of being of little diagnostic value.

The chapter on the nervous system is interesting and instructive. The author gives a large number of reflex signs and the proper method of eliciting them. The one criticism of this section is the failure to give the clinical significance, if any, to be attached to the obtaining of an abnormal response.

The book is well printed on good paper, and the illustrations are clear, good, and well selected. This book is as good as but no better than many other textbooks dealing with the same subject.

HANDBOOK OF ANÆSTHETICS, by J. Stuart Ross, M. B., Ch. B., F. R. C. S. E., *Late Lecturer in Practical Anæsthetics, University of Edinburgh, and H. P. Fairlie, M. D., Anæsthetist to the Western Infirmary and the Royal Hospital for Sick Children, Glasgow.* Third edition. William Wood & Co., New York, 1929. Price, \$3.25

This small handbook is uncommonly well organized, the division of space given to the various subjects corresponding closely to the relative importance of these subjects.

In considering the problem of anæsthesia our great interest lies in the question of safety, with a constant effort to progress toward lower and lower anæsthetic risk, which plays so great a part in the matter of general operative risk.

The authors have kept this phase of the subject always in the foreground, and present here a valuable amount of information which will aid the anæsthetist in his aim of escaping anæsthetic dangers and accidents.

After short preliminary chapters on the physiology of anæsthesia and the mechanisms involved in anæsthetic accidents, there follow some chapters of great practical importance, with clear detailed descriptions of the signs whereby the stage of anæsthesia and the presence of the various dangers may be recognized.

The war surgery brought us greater knowledge of nitrous oxide anæsthesia and a realization of the wide range of its field of usefulness. The authors have given, accordingly, the necessary and well-deserved space to technical details in this type of anæsthesia and have, fortunately, concentrated on two well-known machines rather than adding to confusion by attempting to describe a long list of those now on the market.

Chapters of distinct merit have been added on the subject of local and spinal anæsthesia by W. Q. Wood and on intratracheal anæsthesia by H. T. Thompson.

REGIONAL ANESTHESIA, by *Gaston Labat, M. D., Laureate of the Faculty of Sciences, University of Montpellier, France; Clinical Professor of Surgery, New York University and Bellevue Hospital Medical College; Clinical Professor of Oral and Minor Surgery, New York University College of Dentistry, etc.*, with a foreword by *William J. Mayo, M. D.* W. B. Saunders Company, Philadelphia, 1929

In presenting the second edition of his work on Regional Anesthesia, Doctor Labat has given us practically a new book. The many recent advances in the block method of anesthesia have been included and special attention is given to the principles and technique of the subarachnoid block in the section devoted to that subject. The newest types of equipment are also included as well as the more accurate markings for the injection of the nerve trunks. There is given a few of the basic rules of procedure in chapter 1. Were all operators more familiar with these fundamentals, the field of local anesthesia would be very considerably broadened. The book is well written and easily understood. It is a valuable addition to the work on this subject. Doctor Mayo's foreword is worth careful consideration, giving as it does a conservative opinion of the value of this type of narcosis.

INDEX OF SYMPTOMATOLOGY, by *H. Litheby Tidy, M. A., M. D., F. R. C. P., Assistant Physician, St. Thomas' Hospital; Consulting Physician, Royal Northern Hospital.* William Wood & Co., New York, 1929. Price \$12

Under this title short articles have been collected by various writers, giving the symptomatic picture encountered in the different diseases. The articles are concise and give typical diagnostic features. It offers a ready reference covering the entire field of medicine, for refreshing one's memory of the clinical manifestations of each disease, irrespective of branch or specialty. The subject matter is arranged alphabetically and there is a good index helping to make the mass of material presented in this work easily available. The two outstanding features of the book are its scope and its brevity without loss of essential points.

GYNECOLOGY, A TEXTBOOK OF THE DISEASES OF WOMEN, by *Lynn Lyle Fulkerson, A. B., M. D., F. A. C. S., Instructor in Obstetrics and Gynecology, Cornell University Medical School; Assistant Professor of Gynecology, New York Post-Graduate Medical School, etc.* P. Blakiston's Son & Co., Philadelphia, 1929

Many medical officers have expressed the idea that they have a more particular need for a good text on gynecology than on other subjects, since it very frequently happens that an officer, after several years of duty during which gynecological problems are not present, is transferred to a tropical shore station or is assigned to family practice in the United States where gynecology comprises a large part of his work.

For officers in such a situation this book is highly recommended. It presents in an easily readable form the essentials of medical and surgical gynecology. Leading articles in the literature of each subject are discussed.

The book is strictly up to date and would be a valuable addition to an already large-sized library of gynecological texts.

CLINICAL LABORATORY METHODS, by *Russell Landram Haden, M. A., M. D., Professor of Experimental Medicine, University of Kansas School of Medicine, Kansas City, Mo.* Third edition. C. V. Mosby Co., St. Louis, 1929. Price, \$5

The fact that this is the third edition to appear since 1923 attests its favorable reception by the profession.

The present edition brings the book thoroughly up to date by the omission of certain procedures which have been found to have little or no value and by the inclusion of certain new procedures, such as the blood indican determination and the Kahn test.

The book is well arranged and the material ably presented. It should serve well for the average laboratory worker or the student.

PRACTICAL CHIROPODY, by *E. G. V. Runtting, F. I. S. Ch.* Third edition. The C. V. Mosby Co., St. Louis, 1929. Price, \$3

This is a rather elementary manual covering the care and treatment by chiropodists of certain conditions of the feet. However, there is much good advice and comment relative to the care of the feet, wearing of proper shoes and stockings, etc. The book may be read with profit by laymen, nurses, and others such as military officers concerned with care of the feet of troops.

Treatment of and the application of pads, plasters, and protective devices on the several conditions found upon the feet is discussed with much common sense and cleverness. Operative technique with instruments and the care of instruments is briefly described.

OSTEOMYELITIS AND COMPOUND FRACTURES, by *H. Winnett Orr, M. D., F. A. C. S., Chief Surgeon of the Nebraska Orthopedic Hospital; Orthopedic Surgeon, Lincoln General Hospital; Consulting Orthopedic Surgeon, Bryan Memorial Hospital, Lincoln, Nebr.* C. V. Mosby Co., St. Louis, 1929. Price, \$5

There are several features of the book which irritated this reviewer. In the first place, \$5 is too high a price for a book of 200 pages, especially when the evidences of padding appear as abundantly as they do here. The preface is rather long and rambling and contains a good deal about the author and his teacher and their qualifications, training, experiences, etc. The introduction, by Dr. John Ridlon, contains much about and in praise of the author.

A chapter on "Sir Joseph Lister and Antisepsis" occupies a tenth of the book and probably could have been or would have been done better had less space been given to it.

A chapter on "Lessons from the Great War" contains much of interest and value, but perhaps would be improved by omission of the numerous official War Department letters.

The chapters on osteomyelitis and on compound fractures are quite convincing as to the value of the methods of treatment recommended.

In the chapter on clinical results there appears again much correspondence, which again furnishes the reader with considerable irritation.

Much could be omitted from this book, which would reduce its size and price and result in its improvement as a treatise on osteomyelitis and compound fractures.

SURGICAL RADIOLOGY, by *A. P. Bertwistle, M. B., Ch. B., F. R. C. S. Ed.* P. Blakiston's Son & Co., Philadelphia, 1929

This little book with an introduction by D. P. D. Wilkie, O. B. E., F. R. C. S. Ed., claims to be an attempt to "coordinate and correlate clinical facts with radiological findings."

The title, however, is misleading, as the book is an abbreviated compend of surgical anatomy containing only occasional and rather indefinite reference to radiological findings.

The chapter on infective and toxic conditions under the heading of "Acute osteomyelitis" contains some original statements that reveal a surprising lack of histological, pathological, and radiological knowledge.

The chapters devoted to the alimentary system contain numerous quotations and references from Carmen's book, "The Roentgen Diagnosis of the Alimentary Canal."

The chapter on gall bladder mentions Graham's method, but the technique described is quite different.

The book as a whole is more of a medical literary atrocity than a useful handbook.

DISEASES AND DEFORMITIES OF THE SPINE AND THORAX, by *Arthur Steindler, M. D., F. A. C. S., Professor and Head of the Department of Orthopedic Surgery of Iowa State University Medical School, Iowa City, Iowa.* C. V. Mosby Co., St. Louis, 1929. Price, \$12.50

While the subject covered by this book is one which directly appeals to surgeons, especially the orthopedist, there is much in it of interest to the general practitioner.

The author has developed his subject with strong emphasis on its theoretical and experimental foundation intentionally with the idea of developing orthopedic judgment. The author has carefully refrained from stressing his own individual views, but has given and explained all opinions.

The book is well written and illustrated. The author begins each chapter with an outline of the context and closes with a comment.

Of especial interest to naval medical officers are the chapters on low back pain and chronic arthritis of the spine.

In the opinion of the reviewer, this is one of the most satisfactory books for the general medical man on an orthopedic subject that has been written up to date.

SURGICAL CLINICS OF NORTH AMERICA, FEBRUARY, 1929. W. B. Saunders Co., Philadelphia, 1929

This is the Mayo clinic number and contains many interesting articles by Doctors Judd, Balfour, Meyering, and others.

To the naval surgeon dealing with the usual shipboard emergencies an article on intestinal obstruction by Doctor Dixon and one on fractures of the neck of femur by Doctor Henderson will be especially interesting. There are numerous other articles of pertinent value to the surgical chief, especially those describing the treatment of several cases with unusual surgical complications. An article on the administration of oxygen as a prophylactic against post operative pulmonary complications reports some interesting results.

MEDICAL CLINICS OF NORTH AMERICA, MARCH, 1929. W. B. Saunders, Philadelphia, 1929

The active members of the Southern Interurban Clinical Club are the contributors to the March number of the Medical Clinics.

The volume is very interesting and a little longer than average. The outstanding comment would seem to be that of the article by Dr. C. C. Bass, of New Orleans, who says in an article on pellagra:

These cases, and many more observations by others as well as myself, support the view that the lesions of pellagra may be produced by different resistance that normal tissues have, and that the lesions are produced merely incidentally or, may I say, accidentally in persons who have the general disease.

It is "anybody's guess" as to what is the specific cause of pellagra. All the evidence of which I have personal knowledge, to which I am able to attach

much weight, favors the opinion that it is due to an infection. I am content to remain with the minority who have not been convinced by supposed proof of other causes, and still believe that a specific infection will be found to be the true cause.

The doctor's "minority" is still holding out against all the recently accepted work. Those who have seen and followed the development in our other deficiency diseases certainly believe that pellagra's etiology has been equally as thoroughly established. The contrast between his article and the last in the issue by Doctor Wilkerson concerning balanced feeding and correctly prepared food is a sharp contrast of the importance placed by different groups to the value of balanced rations and correctly prepared foods.

SURGICAL CLINICS OF NORTH AMERICA, APRIL, 1929. W. B. Saunders Co., Philadelphia, 1929

The April surgical clinic comes from Chicago, and the first article by Doctor Bevan is worth the price of the book. Doctor Bevan discusses the acute abdomen, and any naval surgeon who has had similar cases more than appreciates the writer's position.

There are many other interesting articles from the clinics of Doctors Speed, Moorehead, and Curtis, discussing bone and joint conditions. Doctor McWhorter reports a case of amebic abscess of the liver and adds a table including seven other cases.

Doctors Straus and Tumpeer report a case of ruptured spleen with unusual symptoms. There are several other excellent articles of considerable interest, especially those concerning genito-urinary surgery from the clinics of Doctors Eisendrath and Huggins.

THE MEDICAL CLINICS OF NORTH AMERICA, MAY, 1929. W. B. Saunders Co., Philadelphia, 1929

The Mayo Clinic number of the Medical Clinics contains numerous articles of interest. Particularly noteworthy in this respect is the increased attention given by physicians to the question of metabolism as influenced by food intake and also the treatment of patients by diet modification and control. Two articles on the ketogenic diet by Doctors Barborka and Kennedy open a new field.

In the second paper the use of this diet is wholly empirical, still it shows the application in therapeutics of such control. A different type of article by Doctor Alvarez discusses the food poisoning or susceptibility of patients and its relationship to their general physical condition. The clinic of Doctors McVickar and Weir presents several cases of gastro-intestinal importance and an unusual case of syphilis of the stomach. Other instructive reports are those by Doctors Eusterman and Keith on transient methemoglobinemia, Doctor Giffin on polycythemia vera, Doctors Barnes and Yater on

heart conditions, and Doctor O'Leary on the value of treatment by malaria in neuro-syphilis. Space unfortunately prevents full justice to these papers. The issue is completed with the index to the twelfth volume.

SURGICAL CLINICS OF NORTH AMERICA, JUNE, 1929. W. B. Saunders Co., Philadelphia, 1929

This is the New York number and includes the clinics of several prominent New York surgeons. In the leading article Dr. C. S. Heyd records a case of Riedel's struma which was operated in his clinic. In this case there was no thyroid dysfunction, the symptoms being due entirely to compression. The three stages of the disease are described in detail, the histologic data is presented, and the clinical course with recovery after operation is recorded.

Dr. C. H. Chetwood reports two cases which illustrate the importance of modern technic in correct renal diagnosis.

ANGINA PECTORIS, by *Harlow Brooks, M. D., Emeritus Professor of Clinical Medicine, New York University; Visiting Physician, City Hospital; Consulting Physician, Fifth Avenue, French, Polyclinic, Montefiore, Norwegian, and Beth Israel Hospitals, New York City.* Harper Brothers, New York, 1929. Price, \$2.50

Angina pectoris to some physicians and to most of the laity as expressed by the author is tantamount to a death sentence.

In this monograph the author endeavors to differentiate between true and pseudo angina pectoris in a clear, concise manner.

The author places great stress in the treatment of the condition with special reference to the individual. The prophylactic, specific, general, and surgical treatment, as well as the treatment of the attack proper, are discussed under proper headings.

It is a relief to the patient as well as to the physician to feel that life may be prolonged and the patient's comfort enhanced under the present-day treatment of angina pectoris in all of its phases.

This monograph is of convenient pocket size, attractive flexible binding, and of practical value for the student and general practitioner. The printing and type is ideal and restful to the eye—this is a step forward; it would be a pleasure to read if the type in the book was made the standard.

SYPHILIS, by *Charles C. Dennie, M. D., Assistant Professor of Dermatology and Syphilology, University of Kansas School of Medicine; Chief of Hered-syphilitic Clinic, Children's Mercy Hospital; Chief of Syphilitic Clinic, Kansas City General Hospital; Dermatologist and Syphilologist, St. Lukes, Research and St. Mary's Hospitals.* Harper & Bros., New York, 1928. Price, \$2.50

This book is one of Harper's medical monographs. Doctor Dennie in his book goes thoroughly yet in a concise manner into acquired

and heredosyphilis, in all of its stages, and into a description of every organ and system complicated by this scourge.

The different methods of diagnosis and differential diagnosis are discussed; differential diagnostic schematic charts are presented; some illustrations to clarify the different clinical diagnostic procedures are offered. The interpretation of serological technique is explained.

The indication for treatment or continuation of treatment in the different clinical entities of the disease are mentioned. The special therapeutic procedure in cerebrospinal syphilis are discussed.

Syphilis is one disease which concerns all of the different specialties as well as the general practitioner. The monograph is an invaluable asset to any library.

Harper's monographs are handy in size; the printing type ideal and restful to the eye, a step forward; it makes reading a pleasure. Let us hope this type will be adopted as the standard.

A SHORTER SURGERY, by *R. J. McNeill Love, M. D.* Willam Wood & Co., 1929

One more quiz compend for medical students, written with an eye to helping the student pass his examinations. A book of more value to the students who attend the author's lecture course than to any other group. It does not claim to be better than this, and, except as a quiz compend, it has no value.

COLLECTED PAPERS OF THE MAYO CLINIC AND THE MAYO FOUNDATION. Edited by *Mrs. M. H. Mellish, R. M. Hewitt, B. A., M. B., M. D., and Mildred A. Telker.* Volume XX, 1928. W. B. Saunders Co., Philadelphia, June, 1929

This volume of over 1,000 pages is a collection of 429 papers prepared during 1928 by members of the staff of the Mayo Clinic. Eighty-one of the papers appear in complete form; the others are abridged, abstracted, or simply referred to.

They are grouped into the following classes: Alimentary tract; Genito-urinary organs; ductless glands; blood and circulatory organs; skin and syphilis; head, trunk, and extremities; chest; brain, spinal cord, and nerves; miscellaneous.

PROCEEDINGS, FIRST COLLOQUIUM ON PERSONALITY INVESTIGATION. Held under the auspices of the American Psychiatric Association. The Lord Baltimore Press, Baltimore, Md., 1929. Price, paper, 60 cents; cloth, \$1

This compact little volume contains the proceedings of a colloquium participated in by some 20 American psychiatrists of prominence.

Its contents are of more than ordinary interest to naval medical officers, since one of the commonest causes of survey from the service is that of psychopathic personality. A reading of this book should

prove helpful in deciding at the recruiting office whether certain cases are suitable for enlistment and in the decision by medical survey boards as to whether certain cases should be allowed to remain in the service.

A WATER PROGRAM FOR CAMPS, by *Thomas K. Cureton, jr., Director of Physical Education, Suffield School, Suffield, Conn.; Life Saving Field Representative of the American National Red Cross*. Published for the American Red Cross by P. Blakiston's Son & Co., Philadelphia, 1929

This little paper-bound book should be of value to naval medical officers, as it has much to do with the supervision of water sports from the standpoint of measures used for the prevention of drowning. Since drowning is the most common cause of death in the Navy, and many of the cases occur during liberty swimming parties and water-sports contests, the book is of value to line officers as well as medical officers.

It contains many helpful suggestions on the subjects of instruction in swimming and water-sports programs.

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THE DIVISION OF PREVENTIVE MEDICINE

Captain M. A. STUART, Medical Corps, United States Navy, in charge

NOTES ON PREVENTIVE MEDICINE FOR MEDICAL OFFICERS, UNITED STATES NAVY

TUBERCULOSIS

PART II

By M. A. STUART, Captain, Medical Corps, United States Navy

There are few diseases which have attained such a universal distribution as tuberculosis. It was recognized by the people of ancient times, as shown in the previous article, and later accompanied the white man to all the lands into which he has forced his way, notably the interior of Australia, equatorial Africa, and the islands of the Pacific. The American negro has apparently become less susceptible to fatal tuberculosis, and in discussing this question, Col. G. E. Bushnell reached the conclusion that the negro race has become thoroughly tubercularized through close contact with the white man and experiences a high death rate from tuberculosis only when living under very unfavorable conditions. The American Indian, previously free from the disease, has suffered from epidemics of acutely fatal tuberculosis whenever he first came into contact with civilized races and continues to show a much greater susceptibility to the disease than the white man. It is stated that tuberculosis is about five times more prevalent among the Indians of Canada than among the general population. At the present time he is probably in process of becoming tubercularized.

Tuberculosis is generally more prevalent in urban communities than in the rural sections of the country. The figures published by the Census Bureau for the registration States in 1917 give the rate per 100,000 in the cities as 159.2 and in the rural areas as 130.3. In this connection, Dublin (1923) pointed out that many of the sanatoria and hospitals for the tuberculous are located in rural areas and that these civil divisions are usually charged with all deaths that occur there, although many of the patients are city residents. If the necessary corrections were made for original residence, the dif-

ference between the two rates would become the more striking in favor of the country.

The division of vital statistics of the New York State Department of Health, in order to find a more accurate measure of mortality from this disease, started in 1926 to allocate deaths according to residence. The effect of this allocation upon the death rates of the larger divisions of the State in 1927 was as follows:

Area	Death rates per 100,000 population from tuberculosis, all forms	
	Recorded	Resident
New York City.....	86.1	94.7
Rest of State.....	77.5	68.2
Urban.....	64.3	75.1
Rural.....	80.0	56.2

As may be noted from the above table, the allocation increased the rate of New York City by 10 per cent and decreased the rate of the rest of the State by 12 per cent. The most interesting fact is the reversal in the relative position of the rates of the urban and rural sections of the rest of the State. While the recorded rate of rural New York was 24 per cent above the urban rate, exclusive of New York City, the relation between the resident rates is more than reversed and the urban exceeds the rural rate by 34 per cent.

In the registration area of continental United States tuberculosis is responsible for approximately 90,000 deaths per annum, or about 8 per cent of all deaths. The number of sick has been variously estimated at from 5 to 20 times the number of deaths, but taking the estimate of the United States Public Health Service of 15 probable infections with symptoms of the disease, for every death there would be about 1,350,000 cases in this area each year.

The death rate per 100,000 of population in the death registration area of continental United States for the year 1900 from tuberculosis, all forms, is 201.9 and from tuberculosis of the respiratory system, which also includes acute disseminated tuberculosis, 181.8. In 1927 the corresponding rates are 80.8 and 72.5 respectively, or a reduction of approximately 60 per cent during the period 1900 to 1927, inclusive. The State showing the highest rate is Arizona, with a rate of 324.8 for tuberculosis, all forms, and 308.3 for tuberculosis of the respiratory system, while the State showing the lowest is Utah, with corresponding rates of 27.4 and 23.8, respectively.

The death rates per 100,000 of population in United States registration area are given in the following table:

Tuberculosis (all forms)

State	Order of frequency, year 1927	Death rate per 100,000		State	Order of frequency, year 1927	Death rate per 100,000	
		1927	1926			1927	1926
Arizona.....	1	324.8	328.5	West Virginia.....	20	73.5	76.6
Colorado.....	2	138.9	144.2	Rhode Island.....	21	73.3	72.0
California.....	3	135.3	134.8	Ohio.....	22	70.2	76.8
Tennessee.....	4	134.4	147.9	Vermont.....	23	70.1	80.0
Territory of Hawaii.....	5	133.6	129.5	Pennsylvania.....	24	70.0	77.0
Kentucky.....	6	109.5	122.6	Maine.....	25	68.3	70.9
Mississippi.....	7	102.5	109.5	Washington.....	26	67.4	73.3
Maryland.....	8	101.7	113.9	Connecticut.....	27	65.6	76.1
Virginia.....	9	99.6	105.3	New Hampshire.....	28	64.6	70.3
Louisiana.....	10	98.2	105.0	Michigan.....	29	63.7	69.4
Delaware.....	11	93.4	109.2	Wisconsin.....	30	61.6	65.2
North Carolina.....	12	89.0	97.8	Oregon.....	31	59.6	61.8
Alabama.....	13	87.1	94.2	Minnesota.....	32	57.2	63.0
South Carolina.....	14	84.0	91.0	Montana.....	33	52.2	54.2
New York.....	15	82.8	89.8	Idaho.....	34	35.4	34.5
Florida.....	16	81.1	91.1	Kansas.....	35	35.3	40.6
Arkansas.....	17	76.8	(1)	Wyoming.....	36	32.0	26.3
Indiana.....	18	74.8	83.1	Nebraska.....	37	29.2	32.3
New Jersey.....	19	74.7	83.9	Utah.....	38	27.4	33.7

¹ Admitted to the registration area for 1927.

Undoubtedly the high rates recorded by Arizona, Colorado, and California are due largely to the migration of tuberculous persons to those areas, while those of many of the Southern States are in part caused by deaths from tuberculosis among the more susceptible negro population.

Factors in the decline of tuberculosis.—Rosenau states that the decline of tuberculosis, which has been gradual, began even before the nature of the infection was known and that the social and economic conditions of the mass of the population must be improved before any great decrease in the mortality rate can be expected.

It has been shown above that a reduction of approximately 60 per cent in the death rate from this disease took place in the registration area during the 28 years 1900 to 1927. Dublin, from a study of a special but large group of insured lives, found a similar decrease in the 10-year period 1911-12 to 1921-22. Since 1918, reductions amounting to as much as 10 per cent or more a year have been noted. This decline has not been uniform in all population groups, but has favored males more than females, whites more than colored, and certain age groups more than others. In the insured the maximum decline, which amounted to approximately 50 per cent, occurred among white males in the period between 20 and 45 years of age. He noted the greatest decline where the rates were originally highest and least where the rates were lowest. White males showed a decrease of 55 per cent in the death rate from tuberculosis for the 10-year period 1912 to 1922 as contrasted with a decline of only 41.5 per cent in the same period for white females. This will be discussed later.

In New York City, where Biggs, Prudden, and Loomis first applied on a large scale the knowledge made available by the studies of Koch, organized effort against tuberculosis has probably been developed to a greater extent than in any other city in the world.

The death rates from pulmonary tuberculosis per 100,000, New York City, for the years 1881-1928 are given in the following table:

Year	Rate per 100,000	Year	Rate per 100,000	Year	Rate per 100,000	Year	Rate per 100,000
1881.....	386	1893.....	276	1905.....	212	1917.....	163
1882.....	374	1894.....	249	1906.....	216	1918.....	160
1883.....	367	1895.....	262	1907.....	209	1919.....	133
1884.....	358	1896.....	246	1908.....	198	1920.....	109
1885.....	347	1897.....	233	1909.....	187	1921.....	90
1886.....	355	1898.....	236	1910.....	182	1922.....	88
1887.....	330	1899.....	239	1911.....	180	1923.....	86
1888.....	321	1900.....	237	1912.....	173	1924.....	82
1889.....	308	1901.....	229	1913.....	170	1925.....	81
1890.....	317	1902.....	207	1914.....	174	1926.....	81
1891.....	292	1903.....	212	1915.....	169	1927.....	74
1892.....	279	1904.....	218	1916.....	158	1928.....	78

If a curve and moving average are plotted for the above figures, it will be noted that the reduction in the death rate was quite uniform for the years 1881 to 1900, and, though continuing at a slightly lesser rate from 1900 to 1918, became even more pronounced after the latter year. Among the factors responsible for the decline in the death rate since 1918, the epidemic of influenza and improved economic conditions have been mentioned. The epidemic of influenza which began in the fall of 1918 and continued through the winter recurred in somewhat milder form the following two years. During this period a large number of individuals, most of whom were between 20 and 45 years of age and who would ordinarily have died of tuberculosis, succumbed to influenza and their deaths were charged to that cause. This period was distinguished by great material prosperity. Never before, according to Harris, had so many people been gainfully employed; consequently there was very little unemployment. It is interesting to note from the above table that even with intensive organized work against tuberculosis, a slight rise, which may be only transient, occurred in 1928, when there was an increased number of deaths from this cause during the period March to May.

Among the factors responsible for the reduction of tuberculosis, particularly in the United States, may be mentioned the decreased exposure to repeated or massive infection through improvement in the environment of the masses. This is indirectly contingent upon the better conditions under which individuals must work, shorter hours of labor, and increased earnings which have prevailed especially since the World War, and directly upon the early recognition of open cases of tuberculosis with proper disposal of infectious secre-

tions and discharges and the pasteurization of milk in the larger communities, a practice which is being gradually extended throughout the United States. One of the most important measures in preventive medicine is the early detection and isolation of all cases of communicable disease until the individual is no longer capable of disseminating the infectious agent. While it might be desirable, this procedure is hardly practicable in a disease extending over so lengthy a period of time as tuberculosis.

The education of the general public and patients as to the menace of tuberculosis, which has been conducted with increasing vigor during the past 20 or 30 years by local health departments, doctors, hospitals, sanatoria, preventoria, children's health camps, diagnostic clinics, traveling clinics, and public health nurses, has been an important factor in the decreased incidence of the disease. In conjunction with this campaign, the early detection and diagnosis of cases, together with continued supervision of patients until they are no longer a menace to their families or their community, has really resulted in a modified form of isolation of those afflicted and has tended to reduce the spread of infectious material to a minimum.

The isolation and care of open cases in sanatoria has been productive of good results, from an educational standpoint as well as from the benefit the patients receive from hospital treatment. In this connection it is pertinent to call attention to the increase in the institutional facilities for the care of the tuberculous which has occurred in the past 25 years. According to Williams—

The result of the program, forwarded since 1904 by the National Tuberculosis Association, may be seen first in the growth of its affiliated organizations and agencies. When the National Tuberculosis Association was founded in 1904 there were in the United States only 3 State and 15 local tuberculosis associations. Of these, not more than 5 had sufficient funds with which to carry on any kind of program. On January 1, 1926, there were in the United States (not including insular and outlying possessions) 48 State associations (plus 1 in the District of Columbia), 1,154 local associations, and a somewhat indefinite number of loosely organized communities, estimated at 350. In 1904 the 100 tuberculosis hospitals then in existence were for the most part private and commercial, and, all told, provided for 10,000 beds. In 1926 there were 600 hospitals and sanatoria, including 359 State, city, county, and Federal sanatoria and hospitals, with a combined bed capacity of 70,000. The number of open-air schools has grown from the first one in 1908 to approximately 3,000 in 1926 and the number of preventoria from 1 in 1909 to 24 in 1926. Clinics and dispensaries have shown a remarkable growth in two ways: First, in the numerical growth from 25 in 1904 to 600 in 1926; and, second, in kind and method. To-day even the remotest hamlets of the West and South have tuberculosis clinic service through the recently developed ambulant, traveling, and occasional clinic. The number of such individual clinics held in 1925 would aggregate over 2,000. Similarly the public health nursing movement, started in the early days of the National Tuberculosis Association as a tuberculosis agency, has grown to large proportions. Of the more than 11,000 public health nurses

in the United States at present, more than half are devoting all or most of their attention to tuberculosis and a large part of the remainder are doing some tuberculosis work.

Particular interest attaches to the prevention of infection in infancy and childhood. Acting under authority of an Illinois State law, which provides that "no child under 16 years shall live in the same home, apartment, or other place of abode or habitation occupied by a person suffering from active or open pulmonary tuberculosis (consumption)," the Chicago health authorities now insist that contact between children and a tuberculosis patient be broken as soon as possible. "Either the tuberculosis individual must leave home, enter an institution, take up his residence in an abode where there are no children, or the children must leave the home." Similar plans are said to be under consideration in various other cities and is an additional step in the right direction.

Williams (1928) has summarized the most important activities now being conducted by health departments, State, city, and county tuberculosis associations, and other agencies as follows:

1. Compulsory notification of cases of tuberculosis and deaths resulting from tuberculosis.
2. Provision for the free examination of sputum by public laboratories.
3. The adoption and enforcement of ordinances prohibiting expectoration in public places.
4. The protection of the milk supply by pasteurization, tuberculin testing, and other measures.
5. Provision of hospitals for the care of advanced cases of pulmonary tuberculosis and for their compulsory removal from their homes in exceptional cases.
6. The provision of special hospitals for nonpulmonary cases of tuberculosis.
7. The creation of sanatoria for the treatment and education of incipient cases of tuberculosis.
8. The creation and maintenance of clinics and dispensaries for the diagnosis, treatment, and supervision of relatives of indigent patients, either discharged from sanatoria or not sufficiently ill for hospital care.
9. The supervision and education of patients and their families by public-health nurses attached to the dispensaries.
10. Special preventive measures for children who are undernourished or exposed to massive infection with tuberculosis, by open-air schools, open-air classes, and preventoria.
11. Propaganda and educational work seeking (a) to improve the methods of instruction of medical students and nurses on the subject of tuberculosis; (b) to create State and local organizations to organize community programs for control of tuberculosis; (c) to teach the fact that a reduced standard of living increases the likelihood of the development of tuberculosis; and (d) to recommend various procedures to improve the health of the individual and the community.
12. A ceaseless campaign for educating the individual on the nature, treatment, and prevention of tuberculosis; on the modern principles of hygiene; the necessity of good health habits; suitable housing facilities; sufficient amounts of properly prepared food; well-regulated exercises; cleanliness; avoidance of long hours of laborious work and overcrowding; proper ventila-

tion in the home and while at work; and other measures that tend to a proper healthy regimen of life.

As Dublin has aptly stated, "in the last analysis, it is the kind of environment we live in that determines the high or low rate which prevails."

ETIOLOGY

Tuberculosis is an infectious disease caused by the successful invasion of and propagation within the animal body of the tubercle bacillus, or, as it is now designated, the *Mycobacterium tuberculosis* (hominis, bovis, or avium) and is the combined effect produced by any pathological formation, by a functional disturbance which results from this anatomic change, or by the toxic activity of the bacilli.

The three types of tubercle bacilli in the order of their importance to mankind are the human, bovine, and avian. Of these, the latter may be practically disregarded as a cause of human infection, although, according to Randall (1929), Murphy, of the Rockefeller Institute, claims he is finding avian infection in some cases of Hodgkin's disease.

The bovine type is apparently more virulent than the human type for all susceptible lower mammals, including the anthropoid ape, but much less virulent to man. Infection through the gastro-intestinal tract is capable of producing special forms of the disease, but in man this type is rarely found in cases of ulcerative pulmonary tuberculosis.

Park and Krumwiede (1910), in 592 strains of tubercle bacilli isolated from cases of pulmonary phthisis, found only one strain which seemed to be of the bovine type, but they did not accept it as being a typical strain. They found the infectious agent in about 25 per cent of a large series of selected cases of tuberculosis among young children in New York City, however, to be of the bovine strain.

Tulloch et al, in testing 20 of 100 strains isolated from cases of pulmonary phthisis, mostly among adults, found they were, with two exceptions, all of the human type. These two were not completely bovine in character, but were markedly dysgonic as compared with the remaining strains of the series.

In the words of Opie (1927):

The bacteriologic study which we have made of latent pulmonary lesions has shown that they are associated with the human type of bacillus, with few if any exceptions. These observations are in accord with those made on manifest pulmonary disease. Milk is doubtless an important source of tuberculosis which enters the body by way of the gastro-intestinal tract and effects cervical and mesenteric lymph nodes. The bovine type of tubercle bacillus is often demonstrably associated with tuberculosis having its origin in the gastro-intestinal tract, but as a source of tuberculosis of lung or tracheo-

bronchial lymph nodes it is practically negligible save when lesions of these organs are part of a general dissemination through the body.

Some investigators have assumed that the diversity of lesions, a feature commonly noted in these infections, may be explained through variations in virulence of the individual strains of tubercle bacilli. Tuberculosis has long been regarded as one of the most important diseases of cattle communicable to man, and in the light of present knowledge it is undoubtedly responsible for a considerable amount of the infection which causes manifest disease in parts of the body other than the lungs and tracheobronchial lymph nodes. As milk is the principal article of the diet of very young children, the opportunity for massive infection is obviously greater among them than among those in the older age groups. This hazard is being gradually reduced through the use of pasteurized milk, especially in the larger communities. Another important factor in the reduction of bovine tuberculosis is the tuberculin testing of cattle under the supervision of the Bureau of Animal Industry, Department of Agriculture. In 1928 the negative reactors among the cattle in North Carolina were reported as 100 per cent. During the same year approximately 68,000 cattle were tested in Arizona. Of this number, 664 reactors were found, all of which were destroyed. When the test was introduced into this State, from 50 to 100 per cent of positive reactors were found in some localities, but now many counties show less than 0.5 per cent. About 90 per cent of the cattle are subject to this test in Maine and about 50 per cent in New Hampshire, Connecticut, and Vermont.

Naturally some opposition is to be expected on the part of interested persons. An amusing instance of this type was reported in the Health News, New York Department of Health, July 23, 1928:

A dairyman brought his child to the doctor for treatment, but was so wrought up over that part of the sanitary code which relates to the tuberculin testing of cattle that he took some time expressing himself in vigorous language against this procedure, which, he claimed, was not only useless but a menace to the dairy industry. Subsequently he called the physician's attention to the real object of his visit, the health of the child. On the right-hand side of the child's neck was a cervical gland, which, on incision, yielded about an ounce of pus. The father asked the physician as to the probable cause, and on being told that it was undoubtedly due to bovine tuberculosis germs from infected cows in the farmer's herd, the latter changed his criticism and in equally vigorous language berated the department for not compelling every dairyman to have his cows tuberculin tested. He is now strongly advocating this test among his neighbors.

Krause believes this diversity of lesions is explained by sensitiveness to tuberculo-protein and states that it has been simple to demonstrate experimentally, since the recognition of the allergic state, that the changed reacting capacity of the animal largely determines the type of lesion that will result. Thus the acute tuberculosis of children re-

sembles the disease in susceptible animals after first inoculation with virulent tubercle bacilli, while tuberculosis with caseation and even cavity formation resembling the chronic adult type of man sometimes follows a similar inoculation of animals previously sensitized.

Virulence refers to the invasive power of the microorganism in contradistinction to toxicity. The latter implies merely the ability to produce poisons and is not necessarily associated with the power to invade. Rosenau states that some microorganisms, like tubercle bacilli and the spirochetes of syphilis, have a very slow, gradual, but progressive power of invasion owing to the lack of acute physiological reaction on the part of the host, resulting from their presence. Those that possess active invasive powers produce general infections, which are often but not necessarily always malignant. According to Rich and McCordock (1929), if the tubercle bacillus does live and grow freely in the body for any length of time it will unfailingly produce damaging lesions. Such a bacillus is regarded by them as virulent, although the death of tissue is referable more to the development of hypersensitiveness to the protein of the bacilli than to any toxin elaborated by the bacillus itself. While there is some evidence that the tuberculins prepared from different types of bacilli have somewhat different antigenic properties, neither a true exotoxin nor a potent "endotoxin" has been yet obtained from any tubercle bacillus. That a sufficient number of bacilli is the only requirement for the production of lesions, these authors continue, is evident from the extensive, typical tuberculous lesions which can be produced with a sufficient intravenous dose of even the nonpathogenic timothy bacillus. These lesions, however, do not progress beyond a certain point, but tend to regress and to disappear as a result of the recognized inability of this microorganism to continue to live and to propagate freely in the body.

In this connection it is interesting to note that while the transformation of the acid fast timothy grass bacillus into tubercle bacilli capable of causing disease in man and animals through the acquisition of virulence and by adaptation to a new environment was suggested by Von Behring some time ago, all attempts to change non-pathogenic acid fast bacilli into pathogens, as recorded by Calmette (1925), have resulted in failure.

Rich and McCordock, in common with other investigators, have found that different types of bacilli affect a given animal species with different intensity. If rabbits are infected with equal moderate doses of a standard human-type bacillus of low virulence and others with a standard virulent bacillus of the bovine type, those receiving the bovine bacilli will develop extensive and rapidly fatal lesions, while those receiving the human bacilli may live indefinitely and at autopsy show only slight isolated lesions. They have verified

the experience of other investigators that the guinea pig is susceptible and the rabbit resistant to virulent human tubercle bacilli, while both are susceptible to virulent bovine bacilli, the rabbit somewhat more so than the guinea pig. If moderate and equal doses of human-type bacilli of high and of low virulence are given to different guinea pigs, those infected with the virulent strain invariably die of widespread tuberculosis, while those infected with the low-virulence strain practically never do. The results recorded by the above workers, which they state have been the experience of all investigators, indicate that there is a difference in the virulence of different strains of the same type of human bacillus. They state that this difference has nothing to do with species resistance or susceptibility, as any species which is susceptible at all to virulent human bacilli will be correspondingly less susceptible to human bacilli of low virulence. Numerous repeated experiments also indicate that strains of tubercle bacilli of the human type do not assume the characteristics of the bovine type and that strains of low-virulence bacilli are not changed into virulent strains. The reverse is also true. These results emphasize the fact that fixity of type and of the virulence of each strain is an outstanding biological characteristic of tubercle bacilli.

According to Krause, much has been written in support of the theory that secondary invaders, particularly of the pathogenic coccid types, are responsible for the degenerative and inflammatory types of lesions and the acute symptoms encountered in tuberculosis. As a matter of fact, tubercle bacilli without the assistance of other bacteria will give rise to acute inflammations and to liquefying necrosis. The tubercle bacillus, under certain conditions, notably those of allergy, is a pus former, as may be readily observed in a cold abscess or tuberculous pyelitis, where the chances for contamination by other microorganisms are few. A very acute tuberculous process, Krause continues, may exhibit a high proportion of polymorphonuclear leukocytes.

Old pulmonary cavities in direct communication with the upper respiratory tract would naturally be expected to become a fertile place for the propagation of the pharyngeal flora; yet a remarkable circumstance is their frequent freedom from these "invaders." Spontaneous pneumothorax in the greater number of cases results from the tearing of the pleura overlying a tuberculous pulmonary cavity, yet it is rare to find any bacteria but tubercle bacilli in the fluid even of pyopneumothorax. Above all, the mere finding of other bacteria in old tuberculous lesions no more means infection in the sense that these bacteria are exerting a pathogenic effect than would their demonstration in the upper respiratory tract. Nontuberculous bronchiectatic lesions exhibit both pathogenic and nonpathogenic microorganisms of all kinds much more constantly and frequently than do tuberculous lesions, yet the pathological and clinical characters of bronchiectasis are usually quite different from those of tuberculosis.

Cummings (1928), however, in examining sputum secured from 119 patients suffering from pulmonary tuberculosis, isolated hemolytic streptococci, indistinguishable from the ordinary hemolytic streptococci of surgical practice, and states that the occurrence of these microorganisms in the sputum has been shown to be related to a definite but limited extent with the occurrence of hemoptysis and hectic fever and with the mortality. The sputum in 89 of the 119 patients contained a streptococcus which resembled the hemolytic streptococcus, but could be easily distinguished by cultural and serological methods from it and from the *Streptococcus viridans*. This microorganism, which has been termed the *S. pseudohemolyticus*, apparently causes no untoward effects in cases of pulmonary tuberculosis.

Sputum smears stained by the Ziehl-Neelsen method or some modification of it is the procedure usually employed for the identification of the tubercle bacillus. Corper (1928) has pointed out that in order to find tubercle bacilli in the stained smear by microscopic examination the presence of more than approximately 100,000 bacilli in 1 c. c. of sputum is required, while only from 10 to 100 bacilli of a culture whose virulence corresponds to that of 98 per cent of the strains isolated from sputum, is necessary to produce within two months a generalized tuberculosis in the guinea pig. The value of guinea-pig inoculation in doubtful cases is therefore obvious. The disadvantages, however, are the length of time required for the development of the disease, the necessity of making cultures from the animals to identify the type of bacilli, and the expense. In the Journal of the American Medical Association, August 11, 1928, he describes a method and a culture medium which he believes possesses many advantages over guinea-pig inoculation and gives better results than those obtained with other media. He recommends this method for diagnostic purposes when acid-fast bacilli can not be found in stained smears or when it becomes necessary to differentiate the type of bacilli present.

In commenting upon this procedure, Bayne-Jones, of the Rochester Health Bureau Laboratories, writes:

During the past seven months we have been using Corper's culture method in conjunction with the usual staining method of examination of sputum for tubercle bacilli. We have examined in this way 352 specimens. The results have been very favorable to Corper's method, although, of course, we would not abandon the staining method. In general, by using Corper's method, we obtained about 25 per cent more positive results than by the staining method alone. Occasionally, however, stained smears showed acid-fast bacilli when the Corper method failed to give a positive culture.

Fontes, in 1910, was the first to indicate the existence of filterable elements of the tubercle bacillus. More recently Calmette (1928) claims to have isolated virulent filterable elements from pus, sputum

(even negative sputum from so-called "closed" forms of tuberculosis), pleural and peritoneal exudates, fluid from pyopneumothorax, the urine in cases of renal tuberculosis, the blood from cases with severe forms of tuberculosis, and in the menstrual blood of tuberculous women.

These virulent filterable elements, when inoculated on various artificial media, do not yield cultures of Koch's bacilli, but when inoculated subcutaneously, intravenously, or intraperitoneally into sensitive animals, such as the guinea pig, they give rise to glandular lesions which are usually very discrete, in which after prolonged and careful investigation typical Koch's bacilli, isolated or in clumps, may be identified, accompanied in most cases by granululations, a few of which are acid fast.

On the contrary, these findings are not substantiated by Petroff, Alston, and others. As a result of the negative findings from seven types of experiments on this subject, Alston (1928) concludes that the question of the filterability of the tubercle bacillus from all the evidence available at present, is still debatable and requires further experimentation.

The high content of fatty and waxy substances, which make up from 18 to 40 per cent of their dried weight, is responsible for the acid-fast characteristics of tubercle bacilli and differentiate them from other pathogenic microorganisms. Tubercle formation is attributed to the reaction caused by these substances on the tissues. As the body is unable to resolve them into their elementary components and dispose of them rapidly, they are treated by the tissues as foreign bodies.

Allergy, or the Arthus phenomenon, is increased sensitiveness on the part of some of the tissues of the sensitized body to a foreign protein, as evidenced by inflammation, etc., but it may be mentioned that all allergic tissue reactions have the same character regardless of the protein which serves as antigen. Investigations by Rich and McCordock show that allergy resides in the cells and not in the fluids of the body. The allergic state, a most important phenomenon in tuberculosis, is a reaction of the body cells to the protein constituents of the tubercle bacilli. Both tubercle formation and allergy will be produced by the inoculation of killed or living bacilli, but of course the former will not propagate and metastasize as will the latter. Injections of tuberculin cause symptoms of allergy only in man or animals sensitized by a previous injection.

While the tubercle bacillus is not a spore bearer, it is one of the most resistant known pathogenic microorganisms to outside influences. Krause states that—

Three hours' exposure of pure cultures to dry heat at 100° C. will not entirely kill them; moist heat at 55° C. completely destroys their virulence in four hours; at 60° C. in one hour; at 65° C. in 15 minutes; at 70° C. in 10 minutes; and at

95° C. after 1 minute. Protected by mucus they are somewhat more resistant in sputum; when the sputum is moist, and therefore fresh, 15 minutes of steaming at 100° C. will completely destroy the bacilli. They are markedly resistant to putrefaction; tuberculosis material buried in the ground for six months has been found to be infectious. Only certain chemical antiseptics are efficacious and these only after prolonged exposure if the bacilli are in material like sputum. It takes absolute alcohol two hours to render sputum noninfectious and 3 per cent carbollic acid 20 hours to arrive at the same result. Carbollic acid in 5 per cent dilution will kill pure cultures in 30 seconds. The bacilli are, however, very sensitive to direct sunlight; about seven hours' exposure to the direct rays of the sun destroys the virulence of sputum. If kept in the dark they may survive in a dried state for a long time; 16 months after prolonged desiccation of pure cultures *in vacuo* over sulphuric acid the microorganisms have been found to be infectious.

He has shown that tubercle bacilli lose their capacity to continue a vegetative existence *in vitro* long before their parasitic viability has ceased. Few cultures 6 months old can be successfully transplanted to fresh media; yet if the cultures in the original tubes are kept in the dark and in the ice chest for a year and a half they may still be capable of producing disease.

The existence of a peculiar innate resistance to tubercle bacilli in the tissues of individuals of the same species has been the subject of a lengthy discussion for many years, and Krause maintains that the reality of this attribute has never been proved. Rich and McCordock, in the course of their investigations, however, were impressed by the fact that in any large series of animals of approximately the same size, inoculated with the same amount of any type of tubercle bacillus by any route, show marked variations from the average in the extent of lesions, although in general the series will present a fairly uniform pathological picture after a given lapse of time. They attribute this to an alteration of the standard degree of resistance natural to the species by uncontrollable conditions of nutrition and bodily well-being. The occurrence of variations in acquired resistance in human beings during pregnancy and in those with diabetes and other diseases is well known. In this connection it may be stated that Grant and her coworkers have shown that the resistance of the white rat to subcutaneous injections of tubercle bacilli which is naturally high may be reduced considerably through the simple expedient of feeding them on a ration presumably adequate with the exception of calcium and the antirachitic factor. By reducing the intake of vitamin A to a level which was just compatible with life the susceptibility to tuberculo-protein of the white rat infected with tubercle bacilli was increased considerably over that of tuberculous control rats on an adequate diet. It seems, therefore, that individual variations in susceptibility to tuberculosis are intimately associated with environment which together with the influence of race will be discussed later.

Although tubercle formation and tuberculosis is the result of infection by the tubercle bacillus, it is the products of the bacilli and the tubercle that cause disease. It is also true that, of the great number of human beings infected with the tubercle bacillus, relatively few individuals develop symptoms of manifest disease. Symptoms occur either because of the absorption of tuberculo-protein liberated as a result of bacillary disintegration in excess of the neutralizing power of the body or because of "the local irritating or destructive effects of the lesion." While the intensity of symptoms depends upon the extent, location, and character of the focus, the location and character of the lesion are of much greater importance than its extent. Thus, general dissemination of bacilli throughout the body will follow the rupture of a focus into a blood vessel or larger lymphatics. Tubercles are avascular formations, but they are not ordinarily impervious to body fluids. Rich and McCordock state that it is not at all uncommon to see numerous lymphocytes wandering into the freshly necrotic center of a tubercle. "If there are crevices large enough to permit lymphocytes to crawl into the avascular center, surely nutrient fluids could trickle in." This interchange of body fluids depends directly upon the anatomic structure of the tubercle. In the words of Krause—

A poorly invested lesion, one with peripheral sclerosis relatively slight, and one, therefore, with a comparatively pervious envelope, will allow a relatively free egress of focal materials, with a consequent increased absorption by the body and favorable conditions for the dissemination of bacilli and extension of lesion into the neighborhood. As sclerosis and encapsulation are perfected, tubercles become less and less pervious and more and more capable of resisting those physiological fluctuations immediately around them—increased amount and flow of lymph, produced by increased acceleration and amplitude of movements of the tissue or by increased circulatory activity—fluctuations which tend to open the channels of communication between lesion and surrounding tissue. There may even come a time when the sclerosis is so competent, the wall of the tubercle is so dense, that it can withstand the greatest physiological strain at its periphery; and, although bacilli may be interned within the lesion, such a formation is to all intents and purposes no longer a menace to its possessor. If peripheral sclerosis is satisfactory, a vast amount of lesion may be tolerated, with few or no symptoms; if it is incompetent, a very small lesion may be responsible for serious local and constitutional disturbance to the patient.

Paterson utilized increased absorption of material from tubercular foci, which he termed "autoinoculation," in the treatment of the disease by assigning asymptomatic patients to work graded from light exercise to heavy labor.

Much has been written regarding the contributory and more or less immediate determinant or exciting causes of tuberculosis which is summed up by Krause as follows:

Intercurrent infections, especially of the respiratory tract, are perhaps the most common, producing, as they do, not only increased respiratory and general circulatory activity, but also congestions and inflammations of the tissues themselves. Pregnancy, the second stage of labor especially, and lactation will work on occasion toward the same end. Prolonged or sudden and intense physical effort will bring about the same effect. Trauma, applied directly to the infected part, has frequently been observed to precipitate tuberculosis. Emotional stress, especially if prolonged, is a not uncommon forerunner of symptoms. The influence of vicious habits, faulty customs, and sordid modes of life—dissipation, improper housing, inadequate clothing, underfeeding, etc.—is not so direct; these bring in their train exposures and stresses of various kinds and intercurrent diseases, which may then directly affect the focus. Tuberculin in overdose may, by inflaming the periphery of the focus, bring on symptoms that last only for a day or two, or it may increase symptoms already present, or may, for a time at least, convert a chronic or inactive process into an active or acute process.

In this connection it is interesting to note that Papinikolan observed during the epidemic of dengue fever in Greece in 1928 that:

- (1) Dengue fever predisposes persons to pulmonary tuberculosis;
- (2) in some cases it exerts a favorable action on pulmonary tuberculosis that is already present; in most cases in which it exerts an unfavorable action the action is of short duration; (3) dengue fever does not exert an unfavorable action on patients with healed pulmonary tuberculosis.

The real etiology of tuberculosis, however, according to Krause, is bound up with focal activity, which is largely dependent upon physiological relations that obtain around the focus at any particular time.

The location of the focus must also be of importance as concerns the evolution of disease; it surely makes a good deal of difference whether the fortuitous circumstances of infection have placed a certain type of tubercle at a peripheral point, like the apical pleura, or nearer the hilum in proximity to a large vein. Under these circumstances the issue would turn largely on the tubercle's original location.

The element of time is also of great moment. Everything else being equal, the result would undoubtedly be vastly different if a child went through measles at a time that foci of tubercle in its lungs or lymph nodes were poorly invested or a year later when they may have become well sclerosed.

Age and sex.—The decline in the tuberculosis death rate, which has been continuous for the last 20 or 30 years, has been greatest among children under 5 and least in the age group 15 to 24. Dublin concluded from an analysis of the mortality figures of the Metropolitan Life Insurance Co., which indicate conditions similar to those found in the general population of the United States, that deaths from tuberculosis are much greater among males than among females.

Up to the age of 10 years the death rates are nearly the same, but from this point up to the age of 25 or 30 the excess of female over

male mortality is considerable. Beyond the age of 30 the rate for females drops rapidly and continues below that of males throughout the rest of life. Similarly, Green, who made a study of the tuberculosis mortality of Cleveland, Ohio, found that the mortality among females aged 15 to 24 was considerably higher than for men of the same ages and that their mortality was decreasing much more slowly. In Michigan the death rate for females aged 15 to 19 increased from 151 per 100,000 in 1924 to 207 in 1927.

Among the several causes adduced by various writers to account for this difference may be mentioned the increased industrialization of women, the physiological changes attendant upon adolescence, pregnancy, the dieting fad, tightly adjusted or insufficient clothing, deficient pulmonary ventilation due to posture as illustrated by the "college slouch," excessive cigarette smoking, insufficient sleep, poor ventilation, and the dry, overheated atmosphere of office or work-room. Newsholme (1926) reports very much the same experience for England and Wales, stating that in the age group 15 to 25 some unfavorable influence has emerged associated with unemployment, with the increasing migration to towns, and the increase of indoor industrial occupations for both men and women. Menstruation, frequent pregnancies, and child bearing are also very important factors.

Effect of race.—In a study of the mortality of race stocks in Pennsylvania and New York, Dublin and Baker (1920) found that the lowest death rate was among those born in Russia, who are for the most part Jews. This observation has been confirmed not only in the United States but in other points of the world where the mortality of Jews has been studied carefully in comparison with that of their neighbors. Tuberculosis when contracted by them is often of long duration and does not appear to be as fatal as when it occurs among other races. This apparent racial immunity may be explained in part, at least, by the fact that the Jews have mostly dwelt in cities since they have been scattered over the world, living under crowded conditions, often in ghettos, where they were more subject to infection for a longer period than most other races. They have, therefore, become better adapted by a process of natural selection to urban life, which is partly responsible for tuberculosis. Then different food habits and fondness for fats may also have been a **factor**.

Very low rates were noted among the Italians, even lower in some age groups than among those of Russian birth, but it was found that the rates for Jews and Italians showed considerable variation from place to place and were not uniformly low, reflecting, no doubt, the conditions for better or for worse under which the Jews and Italians of this country live. The Austro-Hungarians, many of whom were of Jewish extraction, also showed very low rates.

Lower tuberculosis rates for many age periods were found among the above three nativity groups than among the native whites, who occupied an intermediate position between these three groups and those born in Germany, Great Britain, and Ireland. The highest rates were found among both males and females born in Ireland; in fact, the Irish males in some age groups had as high tuberculosis death rates as have been found among colored males. In New York City, where the Irish immigrant is a city dweller suffering from all the hardships of congested and impoverished city life, the rates were often twice as high as in Ireland, where they were for the most part inhabitants of rural districts. An inherited racial immunity is undoubtedly a factor in the development of tuberculosis, but while one race may have greater natural immunity than another, it is still capable of being modified by the environmental conditions under which the individual races or individuals live.

Korns (1928) reported the incidence of the various forms of tuberculosis found among patients at the Peiping Union Medical College. The information was secured from a study of the case records of 15,431 Chinese and 3,548 other than Chinese patients treated in the hospital at some time during a period of over five years, and of 39,385 out-patients during the two years ending December 31, 1926. Less than half of the patients were from the Province in which Peiping is situated while all the Provinces, including Mongolia and Tibet, were represented. It may be remarked, however, that the hospital population does not represent a fair cross section of the Chinese population and for this reason the figures, while of value, do not give the true incidence of the disease among the Chinese.

Of the in-patients he found that 1,248 Chinese, or 8 per cent, showed clinically some form of tuberculosis while for non-Chinese the figures were 59, or 1.6 per cent. The pulmonary type was found in 642, or 51 per cent, of the Chinese suffering with tuberculosis and in 45, or 76 per cent, of the others. Of the out-patients, 1,815 Chinese, or 4.6 per cent, had a clinically recognized form of tuberculosis while but 12 non-Chinese were so afflicted. Tuberculosis of the superficial lymph nodes was found as follows: In-patients—Chinese, 156 cases, non-Chinese, 5; out-patients—Chinese, 483, non-Chinese, 1.

This author is of the opinion that unfavorable environmental conditions, chiefly overcrowding, promiscuous expectoration, and eating from a common bowl are responsible for the high incidence of tuberculosis among the Chinese. To this may be added excessive exposure to infection through the absence of modern hygiene and treatment with concomitant destruction of infectious material, improper heating of buildings, and the lack of proper or sufficient food and clothing.

Callender and Hall (1925), working in Manila, P. I., state that in 10,000 cases examined post-mortem, tuberculosis was found in 10

per cent. They performed 200 autopsies during their stay of one and one-half years, and except in very young children they found evidences of tuberculosis in every case. They believe that the disease is about two and one-half times as common among Filipinos as among Americans, and that it is usually of the chronic pulmonary type as would be expected in a highly tubercularized community. Most of the deaths occur in the 40 to 49 age group.

In India, Powell (1922) reports that in over 800 autopsies performed on natives there were chronic tuberculous or healed lesions of the lungs is only 2 to 3 per cent of the cases. He is of the opinion that tuberculosis in the native is much more acute than in the European and that recovery seldom occurs.

According to Takano (1927) the average death rate from tuberculosis in Japan in 1920 was 231 per 100,000, as compared with 361 for Japanese cities with a population of more than 50,000.

Environment.—The influence of environment, prosperity, and living conditions in general upon the incidence of tuberculosis is illustrated by the experience of certain European countries during and immediately following the World War. During the years when a remarkable decline in the death rate from tuberculosis occurred in the United States an equally decisive rise took place on the Continent of Europe. Incidental to the war and to the miseries which resulted from it, the death rate from tuberculosis increased in virtually all the countries of Europe to heights equaled only in the years before the tuberculosis campaigns. All the gains of 25 or 30 years, according to Dublin, were apparently lost in the 3 or 4 years of war and in the periods of stringency immediately thereafter.

In the German cities with populations of 15,000 and over the death rate, which in 1913 was 157 per 100,000, rose in 1918 to a maximum of 287. Individual cities like Vienna and Warsaw showed much worse conditions. In 1913 the rates for tuberculosis in these two cities were 302 and 306 per 100,000, respectively. By 1917, at the height of the war, these figures had risen to 425 for Vienna and 840 for Warsaw, declining in 1920 to 405 and 338 per 100,000 of population. Cities which, like Belgrade, passed through long periods of military occupation and food stringency showed maximum rates, rising even to the horrifying figure of over 1,400 per 100,000 during 1918. But the high rates did not continue following the resumption of industry and the return of fairly normal conditions. The most recent figures show that the death rates from tuberculosis are back approximately where they were at the beginning of the war and, in some countries, they have fallen to figures well below those recorded prior to 1914.

Effect of occupation.—Dublin has pointed out that those who are engaged in industrial processes show uniformly higher mortality rates from tuberculosis, as indicated by the lower death rates for females than for males after the age of 25 years, than the general population of comparable age groups. There is much variation, how-

ever, even with males among the several industries and occupations in which people are engaged.

The general conclusion drawn by most students of the relation of tuberculosis to industry has been, according to Dublin, that the highest rates are found among those exposed to mineral and metallic dusts; next are those engaged in occupations related to the use of alcohol; and then those who are exposed to lead.

Certain occupations with exposure to the hardships of weather and occupations with exposure to organic dusts, also are generally found to have a high frequency. Investigation of the factors which enter into the lives of the various classes of industrial workers does not seem to indicate that high and low rates are always the direct influence of the occupation, but are often coupled with the mode of life and the home environment of the individual workers.

Some occupations undoubtedly attract weaker individuals, but even with good initial physical endurance, long hours of toil in confined spaces often poorly ventilated and only too often laden with dusts and poisons, the strain of attention to fast-moving machinery, the effects of heat, and the exhaustion of muscular energy eventually reduce the resistance of the worker.

To these must probably be added the effects of frequent, improper, and inadequate diet, substandard housing, indifferent medical service, and lack of opportunity for rest and recreation which are associated with the life of the poor.

Dust.—Stonecutters and tin miners as a group show exceedingly high death rates from tuberculosis, varying from 700 to 1,200 per cent greater than the corresponding rate among farmers, and is the result of injury to the lung tissues by the material with which they work. This suggests the explanation of the high death rates of workers in other dusty trades. The character of the dust inhaled is an important factor. Silica and other hard dusts cause pneumoconiosis and increased susceptibility to infection by the tubercle bacillus. Coal miners, on the contrary, who are engaged in heavy work and are exposed to dust, inevitably develop pneumoconiosis, but are relatively free from tuberculosis. According to Landis (1925), organic dust, judging from the evidence at present available, never produces pneumoconiosis. It may give rise to protein intoxication, such as asthma and thrasher's fever, and possibly act as the carrier of bacteria into the respiratory tract. The relatively high incidence of tuberculosis is probably due to economic factors rather than the inhalation of dust. It should be borne in mind, however, that dust presumably organic in character may contain an appreciable amount of inorganic material. Greenhow incinerated the lungs from the bodies of two flax-dressers and obtained an ash with a large silica content. The workers while apparently exposed to organic dust were really inhaling inorganic material.

(To be continued)

REPORT OF AN EXPLOSIVE OUTBREAK OF SCARLET FEVER AND ACUTE TONSILLITIS ON BOARD THE U. S. S. "NEW YORK"

By S. D. HART, Commander, Medical Corps, United States Navy

A severe and unusual epidemic of acute tonsillitis and scarlet fever developed on board the U. S. S. *New York* during the month of March, 1929. Not counting 2 cases of tonsillitis which were admitted to the sick list on February 27, a total of 189 cases of this disease occurred in March, and of these 160 were admitted during the four days March 1 to March 4, inclusive. Likewise, of the 83 men who became ill with scarlet fever in March, 76 were admitted during the first four days of the month.

A severe infection of the tonsils with sudden onset was found in all cases and was an outstanding feature of the outbreak. All patients with tonsillitis had greatly enlarged tonsils covered with large areas of exudate. Headache and malaise were prominent symptoms. Temperatures varied from 101° F to 105.4° F. The average duration was 7.5 days. All cases of scarlet fever were characterized by a sudden and severe onset similar to that observed in the cases of tonsillitis. The throats of some patients were much more highly infected than others, and as a rule these patients also had a more marked skin eruption. The longest duration was 51 days and the shortest 28, with an average of 42.5 days.

There were no fatalities and but few complications.

The U. S. S. *New York* was at the navy yard, Bremerton, Wash., undergoing annual overhaul from January 1 to February 15, 1929, during which time there were about 1,000 men on board. This is considerably below the average daily strength of the crew, which usually is about 1,200. Before leaving Bremerton, however, the crew was augmented by 201 recruits from the United States naval training station, Great Lakes, Ill. In addition, about 140 enlisted men were received on board at Bremerton, 87 at San Francisco, and 105 at San Diego, Calif., as passengers for transportation to the fleet at Panama, so that upon leaving San Diego the ship had a crew of about 1,600 men and naturally was greatly overcrowded. Except for a few cases of venereal disease, no case of communicable disease was found either among the recruits or the passengers during a physical examination of these men conducted soon after they were received on board, and in no instance were symptoms discovered indicative of such disease. The itinerary of the U. S. S. *New York* was as follows:

Port	Arrived	Departed
Bremerton, Wash.....	Dec. 31, 1928	Feb. 15, 1929
San Francisco, Calif.....	Feb. 18, 1929	Feb. 19, 1929
San Pedro, Calif.....	Feb. 20, 1929	Feb. 22, 1929
San Diego, Calif.....	Feb. 23, 1929	Feb. 23, 1929
Corinto.....	Mar. 4, 1929	Mar. 4, 1929
Panama.....	Mar. 6, 1929	Mar. 7, 1929
Made transit of canal.....	Mar. 7, 1929	Do.
Colon.....	do.....	Mar. 8, 1929
Guantanamo Bay, Cuba.....	Mar. 10, 1929	Apr. 27, 1929

Upon leaving Bremerton, 1 case of tonsillitis and 2 cases of peritonsillar abscess were under treatment in the isolation ward, but when the ship arrived at San Pedro 4 men were on the sick list with tonsillitis and 4 with peritonsillar abscess. In none of the above cases was a skin eruption observed during the course of the disease. The abscesses were opened and drained. On February 23, when we left San Diego, 2 cases of tonsillitis and 5 of peritonsillar abscess were being treated. Admissions for tonsillitis after this date are shown in the following table:

Cases	Cases
February 27, 1929..... 2	March 14, 1929..... 4
March 1, 1929..... 22	March 15, 1929..... 1
March 2, 1929..... 59	March 16, 1929..... 1
March 3, 1929..... 35	March 17, 1929..... 4
March 4, 1929..... 44	March 19, 1929..... 1
March 5, 1929..... 5	March 22, 1929..... 1
March 6, 1929..... 1	March 23, 1929..... 1
March 7, 1929..... 3	March 31, 1929..... 1
March 8, 1929..... 2	
March 9, 1929..... 3	Total..... 191
March 10, 1929..... 1	

The first indication of an outbreak of scarlet fever appeared on March 1, when 11 recognized cases were admitted. As mentioned above, a skin eruption was not observed in any known case of tonsillitis prior to this date. Cases of scarlet fever were admitted on and subsequent to March 1 as follows:

Cases	Cases
March 1, 1929..... 11	March 7, 1929..... 1
March 2, 1929..... 45	March 14, 1929..... 2
March 3, 1929..... 10	March 20, 1929..... 1
March 4, 1929..... 10	
March 6, 1929..... 3	Total..... 83

Arrangements were made at once to control the outbreak. As the ship was in tropical waters, an isolation ward was improvised by marking off the quarter deck from the forward sections. This was accomplished by double lines of ropes placed 10 feet apart. In order to separate cases of tonsillitis from cases of scarlet fever, the deck was further divided in three sections. The starboard side, Section I, was reserved for positive cases of scarlet fever (those with a skin eruption); the after part, Section II, for suspected cases; and the port side, Section III, for tonsillitis. Sentries were stationed

at the forward line to prevent contact between the patients and the remainder of the crew, awnings were spread over the quarter deck, latrines built over and connected with the scuppers, electric lights were rigged, and all patients put to bed on cots, which were obtained from the first lieutenant. Each patient furnished his own hammock and blankets which were spread on the cots, and brought his toilet articles, a change of underwear and a pair of trousers.

Making facilities for bathing available to the patients proved to be our greatest problem. As long as they were bed patients, they were cared for by the hospital corpsmen, but it was only possible to wash their face and hands and allow them to brush their teeth. When they were permitted to be up, bathing facilities were arranged by blocking off the starboard side of the crew's washroom for this purpose only and by furnishing special buckets. The after hatch on the starboard side was opened at certain hours, and 10 men at a time were allowed to go into the washroom to bathe and scrub their clothes.

A general inspection of the entire ship's company, officers and enlisted men, was made daily during quarters at 9 a. m. by the medical officers for the purposes of detecting and isolating mild or incipient cases, and all men were instructed to report at the sick bay immediately upon the occurrence of headache or sore throat. Men who were on watch during morning quarters were inspected at 1 p. m.

In addition to the above measures, the usual flaming of the scuttlebutt spigots was supplemented by hourly disinfection with formalin. Boiling water is used in the dishwashing machine, with a holding time of 40 seconds. As an extra precaution, however, all mess gear, including knives, forks, spoons, bowls, and cups, were boiled after each meal when they were removed from the machine.

The ship was placed in strict quarantine before arrival at the Canal Zone, where the junior medical officer of the *Wyoming* and five hospital corpsmen were ordered on board for temporary duty. On March 11, or the day after anchoring in Guantanamo Bay, all scarlet-fever patients were transferred to a quarantine camp on McCalla Hill which had been prepared for our use in advance by the personnel of the naval station, U. S. S. *Mercy*, and the U. S. S. *Antares*. Three days later two more patients developed scarlet fever on board and were transferred to the camp. These patients were both men who had handled lines on the quarter deck during the transit of the Panama Canal seven days before. It is believed that they were undoubtedly infected at that time, although a medical officer was constantly on deck to prevent any contact between crew and patients. A hospital corpsman contracted scarlet fever on March 20 and was immediately transferred to the camp. This was the last case of the out-

break. No other hospital corpsman and no officer developed the disease.

The camp was situated on a bluff above the marine barracks and consisted of buildings which formerly had been used by a marine expeditionary force. All activities of the camp were housed in these buildings. The duty personnel consisted of 60 men and 4 officers, including the junior medical officer from this ship and the 5 hospital corpsmen who were received for temporary duty. The medical officer from the U. S. S. *Wyoming* was returned to his ship, as it was felt that we had the outbreak well in hand.

Treatment.—The commissary department made large kettles of soup, which was available at all times during the outbreak. While their temperature was elevated the patients were permitted to have only soup, crackers, and water, but as soon as it returned to normal they were given a meat-free, light diet. Each patient received a bowl and a spoon, which he retained until discharged to duty or transferred to the quarantine camp. These articles were then sterilized in the utensil sterilizer in the operating room and returned to the supply officer. The hospital corpsmen cleaned the patients' mess gear after each meal by first washing it in hot soapy water, followed by rinsing in hot clean water. Two dish pans were issued to each section for this purpose. As soon as a patient became able to, he cared for his own mess gear.

Routine treatment was prescribed as follows:

8 a. m.: One capsule containing quinine, salol, and phenacetin.

2 p. m.: Phenacetin, grs. V.

7 p. m.: Aspirin, grs. V.

Medical officers applied 50 per cent silver nitrate with a swab to the tonsils of each patient upon admission and painted the tonsils with 20 per cent argyrol twice daily thereafter. They also inspected each patient twice a day for a skin eruption.

There were only five tubes of scarlet fever streptococcus antitoxin on board and these were administered to those first affected. It is interesting to note that with these patients the disease was apparently milder and the course considerably shorter than with those who did not receive the serum.

On March 13, in response to a cable request, we received a supply of scarlet-fever toxin from the Bureau of Medicine and Surgery for performing the Dick test and for immunizing all those who should prove to be Dick positive. This toxin was furnished through the courtesy of Doctor Dyer, of the United States Public Health Service. The entire personnel of the ship were given the Dick test, and of a total of 1,608 individuals, 273, or 17 per cent, showed positive reactions. Immunization of the susceptibles with doses of toxin was started at once. Many severe reactions followed, especially after the second

dose. The symptoms included headache, fever, a faint scarlatiniform rash in many cases, and marked desquamation of the skin of the axillæ in one case.

The patients and the duty personnel of the camp were also given the Dick test. Of these, two patients gave positive reactions. They had been transferred to the camp as suspected cases of scarlet fever, and although no rash was apparent, they had been isolated with the positive cases. A course of immunizing injections was started at once. They did not desquamate subsequently, the diagnosis of acute tonsilitis was not changed, and they were later discharged to duty well.

Only one case of scarlet fever occurred after the Dick test was performed. The patient, a hospital corpsman, showed a positive reaction and had received but one immunizing injection of toxin before the disease developed. All positive cases of scarlet fever gave negative reactions to the Dick test. Of the total number of patients who had tonsilitis, 1.4 per cent were Dick positive.

Complications.—Fortunately there were very few complications. One scarlet-fever patient developed pneumonia at the beginning of his attack. He was transferred to the camp after he recovered from pneumonia and later was discharged to duty well. There were 15 cases of peritonsillar abscess; of these, 8 developed in cases of scarlet fever and 7 in cases of tonsillitis. Four patients showed a transient glycosuria.

Termination of quarantine.—As soon as desquamation was completed, patients were returned to duty as follows:

March 30, 1929.....	11
April 11, 1929.....	21
April 17, 1929.....	32
April 21, 1929.....	19

A modified terminal disinfection was observed. Complete baths were taken daily, but the only chemical disinfection was the application of 1 per cent lysol solution to the hands and feet. Each man thoroughly scrubbed his blankets, clothing, and other belongings. He then exposed these articles to the sun for two days prior to his discharge to duty.

Conclusions.—At the time of the epidemic it was thought that possibly some cases of tonsillitis might have been scarlet fever, but daily inspections failed to show subsequent desquamation in any case. One man was found at general inspection of the crew with desquamation of both hands, but it was found that he had neither been sick nor on the sick list at any time and a history of exposure to scarlet fever ashore could not be elicited.

The usual liberty was given to the crew while the ship was at San Pedro. On obtaining the bill of health before leaving this port it

was noted that there were 105 cases of scarlet fever in Los Angeles. It was learned later that scarlet fever was increasing in Los Angeles, and some men reported many houses quarantined in the section where they had been on liberty while the ship was in San Pedro. Reports indicate that in January there were 178 cases of scarlet fever in Los Angeles, 90 in San Francisco, and 5 in Seattle. The figures for February are 232, 163, and 20, respectively, and for March, 315, 353, and 16.

It is the opinion of the medical officer that the disease was introduced on board by members of the crew who contracted the disease in Los Angeles. These cases were probably of such a mild nature that the men did not consider themselves sick and therefore did not report to the medical officer or at the sick bay.

Editor's comment.—The above epidemic, in which approximately 5 per cent of the crew were attacked, is the largest recorded outbreak of scarlet fever on board a naval vessel. Its explosive nature is shown by the fact that of the total number of 83 cases, 76, or 91 per cent, occurred during the first four days of the epidemic. The crest was reached on the second day, after which it rapidly declined. This suggests a common source of infection, such as milk or other food and contaminated mess gear. It is also possible that the disease was introduced on board in a mild unrecognized form simultaneously by several or more members of the crew. The outbreak which occurred at the naval training station, Great Lakes, Ill., during the World War and which consisted of about 200 cases, was similar in many respects. It also began suddenly, ran its course in a few days, and gave rise to very few secondary cases. In this instance food was contaminated by a messman, who had the disease in a mild, unrecognized form.

The following table, compiled from Form F cards received by the Bureau of Medicine and Surgery in 75 cases, shows the distribution by occupational groups:

Cases		Cases	
Apprentice seamen.....	18	Firemen	3
Seamen.....	34	Signalmen	2
Boatswain's mate.....	1	Yeomen.....	2
Carpenter's mate	1	Musician.....	2
Radioman	1	Coxswain.....	3
Enginemen.....	5	Hospital apprentice.....	1
Electrician's mate.....	1		
Gunner's mate	1	Total.....	75

Distribution by age is as follows:

Cases		Cases	
35 years	1	22 years	9
32 years	1	21 years	15
30 years	1	20 years	9
28 years	1	19 years	12
26 years	5	18 years	5
25 years	8		
24 years	1	Total.....	75
23 years	7		

The average age (weighted average) of patients was 22 years. The first cases appear to have occurred among the apprentice seamen and seamen who were undoubtedly more susceptible. Prompt recognition of early cases and isolation of all patients seem to have had a decided effect in controlling the outbreak.

It is probable that the administration of immunizing doses of scarlet-fever toxin to all susceptible members of the crew was a valuable control measure, but it should be remembered that the outbreak was rapidly declining at the time the injections were given and that scarlet fever does not tend to spread under tropical conditions. Nevertheless, active immunization with scarlet-fever toxin is of recognized value, particularly where there is overcrowding, and all measures of demonstrated worth should be employed to control an epidemic, as was apparently done in this instance.

**A FATAL CASE OF ACUTE POISONING BY NEOARSPHENAMINE REPORTED
AS "ENCEPHALITIS"**

In reviewing the death reports, Form N, received by the Bureau of Medicine and Surgery, it was noted that a case of "encephalitis" was admitted from the marine detachment, United States legation guard, Peiping, China, on August 8, 1928, which terminated fatally 17½ hours later.

Reported facts relative to the death were so meager that it was necessary to consult the health record for a more detailed account of the circumstances leading to the fatal ending. This record showed that the patient had completed a course of antiluetic treatment on August 2, or five days before he was admitted with encephalitis.

The patient, a marine private, 28 years old, was first enlisted in the United States Marine Corps on December 10, 1919. His health record shows an admission with specific urethritis eight days later. He was transferred to the Asiatic station, where he developed a chancroidal infection in July, 1921, while stationed at Cavite, P. I., and a second chancroidal infection in August, 1922, while at Peiping, China. According to his health record, he was again admitted with chancroid on board the U. S. S. *Argonne* in September, 1923, while returning to the United States at the expiration of his tour of foreign service. It was thought that this infection had been acquired at Peiping. Upon arrival at a United States port he was transferred to the United States naval hospital, Mare Island, Calif., where his diagnosis was changed to syphilis after a Wassermann reaction and a "check Wassermann" gave a 4 plus result with his blood serum. The reactions were repeated on October 31 with the same results. From September 20 to November 5, 1923, he received six injections

of arsphenamine and four of salicylate of mercury, or a total of 3.15 grams and 0.25 gram, respectively. Following this course of treatment the Wassermann reaction became negative on December 17, 1923. He received five more injections of arsphenamine, or a total of 2.8 grams, from December 26, 1923 to January 30, 1924, and was discharged by reason of expiration of enlistment on February 24, 1924.

He reenlisted in the United States Marine Corps on April 13, 1925. At this time his weight was recorded as 149 pounds and his height as 67 $\frac{1}{4}$ inches. The blood Wassermann reaction was reported negative on June 16, 1925, and again on March 22, 1926. Nevertheless, from June 15 to November 23, 1926, he was given two courses of neoarsphenamine and mercury. The interval between the two courses was three weeks. During the period June 15 to August 24, 1926, he received 5.7 grams of neoarsphenamine and 0.65 gram salicylate of mercury, and during the period September 14 to November 25, 1926, 5.4 grams of neoarsphenamine and 0.65 gram of mercury, or a total of 11.1 grams and 1.3 grams, respectively. In the first course 8 intravenous injections of neoarsphenamine were given and in the second course 7, while 10 intramuscular injections of mercury were given in each course. Neoarsphenamine was omitted on September 9 and November 18, 1926, on account of albuminuria. The next recorded blood serum reaction was on April 10, 1928, when the Kahn test was found to be negative.

On June 14, 1928, following exposures in Peiping May 2 and June 1, he developed a "typical ulcer" on the penis. A dark-field examination of material from the ulcer was recorded as positive for the *Treponema pallidum*, and he was again admitted with syphilis, which was regarded as a reinfection. On August 2, 1928, he completed a course of antiluetic treatment in accordance with the "Outline of anti-syphilitic treatment, United States Asiatic Fleet," which consisted of 8 intravenous injections of neoarsphenamine and 10 intramuscular injections of mercury. He presumably received about 5.7 grams of neoarsphenamine and 0.65 gram of mercury. It was stated that no reactions or jaundice were noted during this course of treatment.

The fleet surgeon, Asiatic Fleet, states that the "Outline of anti-syphilitic treatment" has been in use for several years as a record of treatment, but has not been considered a part of the fleet regulations.

He was admitted to the sick bay at 7 a. m., August 7, complaining of headache, dizziness, nausea, vomiting, constipation, weakness, and pain in the lumbar region. He stated that on the evening of the preceding day, or on the fourth day after he received the last intravenous injection, he felt very weak, but instead of seeking advice from a medical officer he took a dose of "fruit salts" and went to bed. Vomiting occurred once during the night. A physical examination

after admission was essentially negative, but urinalysis showed a few red and white blood cells and a trace of albumin and sugar. The white blood cell count was 16,000, blood sugar 266 mgs., and the blood pressure 140/70. He was given an enema and then placed in a hot pack. A slight convulsion, which lasted a few seconds, occurred at noon, but four hours later, or about 125 hours after the last intravenous injection, he had a second convulsion, which was described as "marked." He became comatose and was transferred to the Peiping Union Medical College Hospital for further treatment. Physical examination upon admission to this institution revealed a temperature varying from 39.2° C to 40.7° C., pulse 100 to 120, respiration 28 to 36, blood pressure 176/72, spinal fluid under low pressure, and a slight urticarial rash over the abdomen. The patient was unconscious and had diffuse, coarse, moist rales both lungs, tracheal rales, and marked cyanosis limited to the head and the region above the clavicle. He had a suggestive Balinski reflex, and the knee jerks were stronger in the left than in the right knee. The abdominal reflexes were absent. No change was noted in the urinary or blood findings. The clinical diagnosis was acute encephalitis, acute unclassified nephritis, and pulmonary cedema, with the possibility of a complicating broncho-pneumonia, cerebrospinal syphilis, and cardiovascular nephritis.

His condition rapidly became worse and death took place at 2.30 a. m. August 8, 1928.

Necropsy report is as follows:

MACROSCOPIC EXAMINATION

Body.—The body is that of a well-developed and nourished white male adult weighing 69 kilograms and measuring 176 cm. in length. Pupils are equal, regular about 5 cm. in diameter. Conjunctivæ slightly hemorrhagic. There is no evidence of jaundice. Ears, nose, and mouth are negative. Rigor mortis complete. Lividity on dependent parts of the body. An area of excoriation of skin about 3 cm. in diameter is present over the right greater trochanter. Penis shows a small scar area on the foreskin. Testes are normal. One needle puncture wound is present in each antecubital space.

Peritoneal cavity.—No free fluid or adhesions. Diaphragm fourth rib right and fifth rib left.

Pleural cavity.—No adhesions or excessive free fluid.

Pericardial cavity.—It contains a normal amount of straw-colored fluid.

Heart.—Weight 390 gms. In the epicardium numerous small punctate hemorrhages are present. The myocardium is firm, but rather pale. The endocardium is not remarkable except for the presence of occasional small hemorrhages. The valves are normal in gross. Measurements: Tricuspid, 12.5 cm.; mitral, 9.5 cm.; pulmonary, 6.6 cm.; aortic, 6 cm. Thickness of the left ventricular wall, 1.3 cm.; thickness of the right ventricular wall, 0.3 cm.

Lungs.—Both lungs are distended, fairly edematous, and congested in their posterior portions. The cut surfaces are very moist and covered with a thin froth. There is no area of solidification present. Bronchial lymph nodes are very small and not remarkable in gross.

Spleen.—Weight 255 gms., moderately enlarged, very soft and flabby. Surface shows white prominent lymph follicles. On scraping a fairly large amount of pulp is carried away with knife.

Liver.—Weight, 1,700 gms. Surface shows irregular patches of yellow; lobules are not sharply outlined. On section the lobules are more easily identified. Their central two-thirds are of light reddish color, while their peripheral one-third has a yellowish tinge. Throughout the cut surface are irregular patches of liver tissue, which are pale yellow in color.

Gall bladder and bile tracts.—Negative.

Pancreas.—Weight 100 gms. Normal in gross.

Gastro-intestinal tract.—Esophagus, stomach, small and large intestines are normal.

Kidneys.—Right weighs 178 and left 185 gms. Each is fairly congested. The capsule strips off readily, leaving a smooth surface with an occasional slight tear. The renal tissue is greatly congested throughout. On section cut surface shows normal markings. The cortex measures 4 mm. thick. The blood vessels and the glomeruli are greatly congested. Pelvis and ureter are normal.

Organs of neck, adrenal glands, urinary bladder, seminal vesicles prostate, and testes.—They are normal.

Aorta.—The aorta shows early arteriosclerotic change in the intima.

ANATOMICAL DIAGNOSIS

Extensive multiple hemorrhage in the brain, with focal necrosis; multiple small hemorrhage in epicardium; early broncho-pneumonia; acute splenic tumor; fatty change in liver; fibro-myxoma of kidney; slight chronic prostatitis; slight arteriosclerosis of aorta; scar of penis.

MICROSCOPICAL NOTES

Heart.—In the epicardium there are a few lymphocytes. In the myocardium a few such cells are found around some of the small vessels. The cardiac fibers are not remarkable. The endocardium shows no significant changes. The blood vessels in the entire section are moderately congested. There is no fatty change in the myocardium.

Lung.—The air sacs are mostly filled with coagulated albuminous material-œdema. Many of them are filled instead with blood, fresh hemorrhage. There are several small areas in which the bronchioles and the air sacs contain large numbers of polymorphonuclear leucocytes. The capillaries are congested throughout.

Spleen.—There is extensive hemorrhage in the pulp, which is heavily infiltrated with leucocytes, chiefly of the neutrophilic type. The follicles are not remarkable. The blood vessels practically uniformly show hyaline change in the intima. The capsule and the trabeculæ are normal in appearance. There are no large phagocytic endothelial leucocytes, as are found in typhoid, nor are there cells with pigment of any kind. The picture presented here is that of acute splenic tumor.

Liver.—The periportal tissue shows slight to well-marked lymphocytic infiltration. There are also in the lobule one or two small foci of polymorphonuclear leucocytes and endothelial leucocytes, in which the liver cells have disappeared. These are, however, situated so near to the edge of the lobule that they may be in reality connected with the periportal tissue. The liver cells show no significant changes; those in the central portion are slightly larger than those at the periphery and contain large numbers of fine fat globules in their cytoplasm.

Pancreas.—Rather marked post-mortem change. The islands of Langerhans are not sclerosed, nor do they show any signs of degeneration.

Large intestine.—The mucosa shows marked post-mortem change. The rest of the wall is not remarkable.

Kidney.—The glomeruli are greatly congested; the capsular spaces are distended, due to edema. There is, however, no evidence of inflammation. Very few sclerosed glomeruli are present. The convoluted tubules are swollen, and their lumens are narrowed. The epithelium is granular. No blood cells or casts found in the lumen of the tubules. There is no glycogen present in the epithelium of Henle's loop. The blood vessels are congested, but there is no other important change. In one section there is a sharply circumscribed tumor made of fibrous tissue, with formation of mucin, which is stained bluish in H. E. sections and reddish with thionin. There is no fatty change in the renal epithelium.

Adrenal gland.—No important change seen.

Prostate.—A few foci of lymphocytic infiltration around some of the glands.

Retroperitoneal lymph nodes.—Slight sclerosis and congestion of blood vessels.

Muscle of chest, thymus, thyroid, urinary bladder, and testes.—These show no significant change.

Aorta.—Slight sclerosis of intima.

NEUROLOGICAL REPORT

Macroscopic.—Dura normal. Brain not swollen. Pia dry on convexity, a little hyperemia, not cloudy or locally infiltrated. Vessels at base are all patent. No signs of arteriosclerosis. The surface of the cerebellum shows some red spots, which, on cut surface, are hemorrhagic infiltrations of the nerve tissue. The largest is about 6 mm. broad. On opening the interhemispherical sulcus we find one part of the corpus callosum dotted with red spots and softer than the surroundings. The ependyma of both lateral ventricles shows also these red punctiform hemorrhages, distributed more in the central part than in the anterior and posterior horn. However, the frontal pole of the temporal ventricle again shows these changes, and the nucleus amygdalae is much more red than normally. The third ventricle and aqueduct are free from macroscopic changes. Frontal sections through the right hemisphere fail to show changes in the tissue; also no macroscopic changes in the substantia nigra or the eye muscle nuclei. The spinal cord does not show macroscopic changes. The fourth ventricle shows punctiform hemorrhages, especially in its cerebellar surface. The cerebellar cortex shows a great number of small discolored areas from 1 to 10 mm. There is hemorrhagic infiltration of the cortex, wedge-shaped in the depth, with some softening of the tissue. There is no evidence of any affection of the pial arteries or veins on the surface of the cerebellum.

Microscopic.—Paraffin sections of cerebellum. Serial sections are made of one hemorrhagic focus and several centimeters of its supplying artery. The artery is filled with blood, but does not show changes in its wall or signs that point to thrombosis. The hemorrhages are distributed mostly in the cortex, but some of them are found in the underlying white matter. Most of these contain only a few red blood corpuscles outside the vessels. These vessels are difficult to find in most lesions. Sometimes we find larger hemorrhages in the molecular layer, also arranged in longitudinal direction. The foci in the granular layer in most instances are round. Another type of hemorrhage is the ring hemorrhage with central necrosis. Between this necrosis and the red blood cells lies a ring of small nuclei. The vessels leading to hemorrhages sometimes show thickening of the wall and light bluish color in haematoxylin stain. In other places we find

necrosis of nervous tissue. This may be a diffuse disappearance of a number of granule cells and degeneration on disappearance of Purkinje cells; but sometimes there seems to be softening of the molecular layer, which lost its staining power. Around these foci we can often find small vessels surrounded by a number of polynuclear leucocytes. This is the commonest type of white cell infiltration. In other places a single lymphocyte or plasma cell can be found in the vessel sheath. There are some places where edema is apparent and probably coagulated protein can be found. The Purkinje cells are absent in the necrotic parts and show marked degeneration in those parts where many hemorrhages occurred. They may be normal in the adjoining parts. This whole picture gives me the impression of hemorrhagic infarction, due to lesion of the small vessels. Lesion of the larger supplying artery would probably have given more distinct changes in all the Purkinje cells of the area; also lesions of the larger arteries in this block have not been found, whereas swelling of the wall of these vessels was often seen. The ring hemorrhages with central necrosis probably prove that the vascular disease is a couple of days old. If these were due to encephalitis, we ought to have found massive mononuclear infiltration, which is absent. Therefore, encephalitis of the ultravirus type can be excluded. The polynuclears point only to the acute necrosis of nervous tissue in some places. Van Gieson sections show the same swelling of the wall of capillary vessels without much endothelial proliferation. It is difficult to find in the affected areas capillaries that are normal. There is no hyperemia present. The hemorrhages in the corpus callosum give essentially the same picture. But we find endothelial proliferation in some places; also marked swelling of walls sometimes. Fat stain does not show any degeneration.

CONCLUSION

The paraffin material shows that there is a hemorrhagic infarction in various places of the brain, due to lesion of the smaller vessels. The vascular disease is probably several days old. It is possible that the acute degeneration of the vessel walls came on in vessels already changed, but no definite proof of this can be found.

BACTERIOLOGICAL REPORT

Incubation of heart's blood, bile, spleen, kidney, and liver tissue on blood agar plates and inoculation of heart's blood and bile in meat in fusion broth gave no growth after 48 hours' incubation.

BACTERIOLOGICAL DIAGNOSIS

No growth from heart's blood, bile, splenic tissue, kidney tissue, and liver tissue.

The findings, which are consistent with poisoning by neoarsphenamine, are pulmonary edema and focal hemorrhages in the cortex and base of cerebrum and cerebellum associated with absence of an inflammatory reaction. The hemorrhagic areas have progressed to variable degrees of necrosis. Microscopical examination shows that the hemorrhagic infarction of the brain is due to lesions of the smaller vessels. The vascular disease is probably several days old. The apparent absence of conspicuous liver lesions and associated jaundice is apparently due to the rapidly fatal outcome. In this case

original syphilitic infection had apparently been cured and reinfection had taken place. The picture is encephalitis, acute, hemorrhagic, toxic, presumably delayed arsenic poisoning. The primary cause of death therefore is "syphilis" and secondary "poisoning by neoarsphenamine (acute hemorrhagic encephalitis)."

Death in this case was probably due to tissue changes started by the cumulative action of neoarsphenamine given from June to November, 1926; and precipitated by the administration of several maximum doses during the course of treatment which the patient received a short time before his death. Some medical officers undoubtedly still regard the maximum dose 0.9 gm. of neoarsphenamine and 0.6 gm. of arsphenamine as the dose ordinarily to be administered without taking into consideration the body weight, amount of previous medication, or condition of the patient.

The treatment of syphilis, as well as other diseases, must be left to the judgment of individual medical officers, and it is not the intent of the Bureau of Medicine and Surgery to promulgate a standard system of treatment for use in the service. Considering the number of injections of an organic arsenical compound which have been administered to personnel of the naval service, alarming, severe, or even fatal reactions have not been numerically great. The frequency, however, with which these reactions have followed the intravenous injection of the maximum dose of the above two arsenical preparations would seem to indicate that in some instances, at least, proper consideration has not been given to all factors regarding the patient before the size of the dose has been decided upon.

In this connection it is deemed advisable to call the attention of medical officers to information on this subject contained in "New and nonofficial remedies, 1929." The dosage recommended for arsphenamine in this publication is from 0.2 to 0.4 gm. Although 0.6 gm. may be given, the smaller doses are being more extensively used. The dose should be varied according to the strength and condition of the patient. Neoarsphenamine may be given in larger doses than arsphenamine because it contains less arsenic and is less toxic. The average dose for a man is 0.6 to 0.75 gm., with possibly 0.9 gm. as the maximum for very large men.

Valuable data on this subject are contained in the "Letter from Berlin" in the Journal of the American Medical Association of February 9, 1929 (p. 489), to which reference was made in the April, 1929, issue of the BULLETIN.

Injections of an organic arsenical preparation, according to this article, should be given with great caution and only under especially important indications during acute, even though mild, disturbances of health such as common colds, sore throat, and indigestion. These

preparations should be entirely omitted in disturbances of a more severe nature; likewise, in the case of persons who did not tolerate the last injection well and are still suffering from its effects. "Injections of arsphenamine should not be given on an empty stomach or after a heavy meal."

Particular attention is invited to the following paragraphs:

Especial care in the use of arsphenamine preparations is necessary also in markedly undernourished, cachectic, and highly anemic patients; patients with status thymolympathicus; diabetes, goiter, exophthalmic goiter, and Addison's disease; pulmonary tuberculosis; disturbances of the heart and blood vessels; diseases of the liver and the digestive organs; obesity, alcoholism, and erysipelas, and diseases of the kidney or when kidney disease is suspected; likewise in pregnancy. In such cases one should proceed cautiously with trial doses and go over to full doses only if the trial doses are well borne. Similar precautions should be observed in the case of syphilitic patients with manifestations indicating involvement of the central nervous system.

The size of the doses to be used in intravenous injections must be determined on the basis of the body weight, the general condition of the health, and the seat, nature, severity, and extent of the existing syphilitic manifestations. For the first injections small doses are recommended (dosage I and II, from 0.1 to 0.2 gm. of arsphenamine, from 0.15 to 0.3 gm. of neoarsphenamine or sodium arsphenamine, 0.1 gm. of silver arsphenamine, from 0.1 to 0.3 gm. of neo-silver arsphenamine; in sturdy young men, at the most dosage III, 0.3 gm. of arsphenamine, 0.45 gm. of neoarsphenamine or sodium arsphenamine, 0.25 gm. of silver arsphenamine, from 0.3 to 0.4 gm. of neo-silver arsphenamine), and for the later injections the larger doses are advised (dosage III and IV, from 0.3 to 0.4 gm. of arsphenamine, from 0.45 to 0.6 gm. of neoarsphenamine or sodium arsphenamine, from 0.25 to 0.3 gm. of silver arsphenamine, from 0.3 to 0.45 gm. of neo-silver arsphenamine). Even for the purpose of abortive treatment, and though the patients are strong and otherwise healthy men, dosage IV (0.4 gm. of arsphenamine, 0.6 gm. of neoarsphenamine or sodium arsphenamine, 0.3 gm. of silver arsphenamine, 0.45 gm. of neo-silver arsphenamine), and in women dosage III (0.3 gm. of arsphenamine, 0.45 gm. of neoarsphenamine or sodium arsphenamine, 0.25 gm. of silver arsphenamine, 0.4 gm. of neo-silver arsphenamine) should not be exceeded as a single dose.

The dosage for infants per kilogram of body weight varies as follows: Arsphenamine, from 0.007 to 0.002 gm.; neoarsphenamine or sodium arsphenamine, from 0.01 to 0.03 gm.; silver arsphenamine, from 0.005 to 0.0075 gm.; and neosilver arsphenamine, from 0.007 to 0.025 gm.

The total amount of arsphenamine that may be administered intravenously to a patient within an interval of six weeks, when only arsphenamine is employed, should not ordinarily exceed from 2.5 to 3 gm. of arsphenamine, from 4 to 5 gm. of neoarsphenamine or sodium arsphenamine, from 2 to 2.5 gm. of silver arsphenamine, or from 4 to 4.5 gm. of neosilver arsphenamine. For a thorough complete treatment the following totals, varying with the type of substance, are recommended: For men, from 3 to 4.5 gm. of arsphenamine, from 4.5 to 6 gm. of neoarsphenamine, from 2.5 to 3.5 gm. of silver arsphenamine, from 4 to 4.5 gm. of neosilver arsphenamine. For women: From 2.5 to 4 gm. of arsphenamine, from 4 to 5 gm. of neoarsphenamine or sodium arsphenamine, from 2 to 3 gm. of silver arsphenamine, or from 3.5 to 4 gm. of neosilver arsphenamine. However, if there is any special occasion for it, these doses may be exceeded if the patients are otherwise sturdy. The use of the maximal

amounts is permissible, however, only when the treatment continues to be well borne. If arsphenamine is combined with bismuth or mercury, cautious administration, together with close observations of the patient during the treatment, is required.

It may also be stated that the administration of a mercurial conjointly with an organic arsenical preparation is regarded by many syphilographers as an extra-hazardous procedure.

A CASE OF YELLOW FEVER AMONG PERSONNEL ATTACHED TO THE UNITED STATES NAVAL MISSION TO BRAZIL

By R. A. WARNER, Captain, Medical Corps, United States Navy

Yellow fever has been endemic and epidemic in the tropical and subtropical parts of the Western Hemisphere for many years. Preventive measures adopted by the different countries concerned or by the various governments in cooperation with other agencies, had by 1925, eradicated the disease from all parts of this hemisphere except northern Brazil. By 1927 yellow fever was apparently under control in the chief ports of northern Brazil and it was thought that the lack of susceptibles would in time cause it to disappear from the interior of the country.

In May, 1928, the disease reappeared in Rio de Janeiro for the first time since 1908, when it was stamped out as the result of an intensive campaign conducted under the direction of Oswaldo Cruz. Its introduction into the city is attributed to mild unrecognized cases among troops transferred to the capital from northern Brazil. The disease rapidly assumed epidemic proportions and attained its maximum intensity in June and July. A few isolated cases were reported from July until the latter part of December, when it again became epidemic. The distribution of cases and deaths, by months, from June 1, 1928, to May 18, 1928, is as follows:

Date	Cases	Deaths
1928:		
June.....	50	24
July.....	40	26
August.....	14	4
September.....	12	10
October.....	4	3
November.....	2	1
December.....	2	0
1929:		
January.....	29	14
February.....	50	32
March ¹	188	145
April.....	213	109
May.....	79	46
Total.....	683	414

¹ Cases not reported for week ending March 16.

Omitting from the above figures 32 deaths which occurred during the week ending March 16, the indicated case fatality rate is 55.9 per cent. While this rate is considerably higher than the expectancy, it should be borne in mind that undoubtedly many more cases of the disease were not reported. In this connection Rosenau writes, "I have been through some yellow-fever epidemics with a case fatality rate of 37 per cent, and through others a few years later in which the rate was less than 5 per cent."

Information received from an authoritative source in February, 1929, indicated that the recent death rate in Brazil is about 10 per cent of the total number of cases. On this basis, about 4,140 cases of yellow fever occurred in Rio de Janeiro during the period June 1, 1928, to May 18, 1929, inclusive.

The distribution within the city is still general, with a continued appearance of cases from established foci, even within the best residential sections. The public health department has been making extraordinary efforts to eradicate the disease, which, if continued during the colder months of the year, should result in considerable success. The extension of foci in the outlying districts, however, will probably result in the reintroduction of the disease next year.

Dr. Henrique de B. Aragão has been conducting a series of experiments at the Oswaldo Cruz Institute with the purpose of developing a vaccine against yellow fever. The *Macacus rhesus* monkey was infected experimentally, and the liver, kidneys, and brain of animals dying from the disease was used in the preparation of the vaccine, which was then sterilized with phenol and formol. At about the same time Doctor Hindle, in London, was working with a similar vaccine and announced his results while Doctor Aragão was preparing his findings for publication. Working independently, both developed the same idea along the same line of reasoning, and both found their vaccines highly protective for monkeys. Over 1,500 immunizing doses of this vaccine had been administered to persons living in or near Rio de Janeiro. The reactions were either mild or absent, and apparently no case of yellow fever developed among those so protected. It was, therefore, decided to offer the vaccine to the personnel of the Naval Mission, and the first individual was inoculated on January 26, 1929. As no appreciable reaction or inconvenience was observed during the following week, the vaccination of all persons attached to the mission was started. With the exception of one officer, who had a severe anaphylactic reaction following an injection of tetanus antitoxin, all officers and chief petty officers had received the vaccine by February 27, 1929.

On February 9, or eight days after the inoculation, a chief machinist's mate suddenly became ill. He had spent the preceding

week working on board a Brazilian naval vessel from which a patient sick with yellow fever had been removed. During this time the ship was in a dry dock located on an island where several cases of the disease had already occurred both ashore and aboard other vessels moored to the docks and would seem to indicate that the island contained a focus of infection.

The symptoms in this case were slow in developing. Although the fever was high from the beginning, ranging from 103° F. to 104° F. and ultimately reaching 105° F., the diagnosis could not be definitely established. While the patient has been critically ill, convalescence is now well established, and he was up and about on February 27. Infectious jaundice, or Weil's disease, was considered as a possibility in this case, but microscopical examinations of the blood and urine and the inoculation of guinea pigs have failed to demonstrate the presence of the *Leptospira icterohaemorrhagiae*.

In order to prove that this is a case of yellow fever, the first which has developed in an individual after protective inoculations by the Aragão method, blood from this patient was sent to the laboratories of the Rockefeller Commission and the Oswaldo Cruz Institute for testing its immunizing properties by injection into susceptible monkeys before inoculating them with yellow-fever virus. Dr. W. A. Sawyer, of the Rockefeller Foundation, in a letter dated June 13, 1929, states that the blood serum from this patient conferred no protection to monkeys subsequently inoculated with yellow-fever virus.

A monkey was inoculated intraperitoneally with 1.5 c. c. of the serum per kilo of body weight, our usual dosage for sera from recent cases. Six hours afterwards monkey blood virus of the Asibi strain was injected subcutaneously in a dosage of 0.2 c. c. per kilo. The monkey came down in 2 days and died in 4.5 days, and showed typical lesions of experimental yellow fever at necropsy.

In the same series tests were made of sera of six monkeys which had recovered from experimental yellow fever after inoculation with the F. W. strain from Rio de Janeiro. All of these sera have so far protected completely. The full observation period has not yet run. Two control monkeys which did not receive serum were inoculated; one received the same dose of virus, and the other, one one-hundredth of the dose. Both came down in 2.5 days and died in from 4 to 4.5 days. A monkey receiving a double quantity of human serum died in 6 days.

The fact that the patient was still markedly jaundiced nearly two months after the onset of the attack and gave the history of a relapse after leaving the hospital is suggestive of infectious jaundice. Doctor Sawyer is planning to conduct further investigations with regard to the action of the serum on the *L. icterohaemorrhagiae* by the Pfeiffer test as soon as the necessary cultures can be prepared.

This case presented some clinical features suggesting that the vaccine modified the severity of the attack and possibly may have

enabled the patient to recover. For instance, the onset, which was sudden and severe, was followed by continued high fever. There was, however, no nausea or vomiting. Albuminuria appeared relatively late in the course of the disease. Anuria, accompanied by a "shower of casts," did not occur until the sixth day of the disease, and jaundice was similarly late in developing. Albuminuria and casts disappeared very rapidly from the urine. More recent information would seem to indicate, however, that 11 cases of yellow fever have been reported as occurring in individuals who have received the vaccine, and consequently its efficiency as an immunizing agent of value to man is questioned.

If this patient had yellow fever it is the first case of that disease which has occurred in the United States Navy since 1919, when 14 cases were reported. Of these, two developed on board the U. S. S. *Chicago* at Amapala, Honduras, and the remainder at the United States legation guard, Managua, Nicaragua.

UNAUTHORIZED SUBSTITUTION OF JUGS FOR THE SANITARY SCUTTLE BUTT

PROBABLY RESPONSIBLE FOR AN OUTBREAK OF ACUTE TONSILLITIS ON BOARD THE U. S. S. "PENNSYLVANIA"

By D. O. ZEARBAUGH, Lieutenant, Medical Corps, United States Navy

An outbreak of acute tonsillitis, involving 71 members, or about 7 per cent, of the crew, occurred on board the U. S. S. *Pennsylvania* during the 7-day period August 24 to August 31, 1928. A study of the records showed that the outbreak was not confined to any particular part of the ship and that the personnel of the various divisions were about equally affected.

The U. S. S. *Pennsylvania* sailed from Honolulu, after a visit of eight days, for Seattle, Wash., on August 20, 1928. Squally weather was encountered two days later, and on the evening of the third day a rather cold drizzling rain prevailed during the "movies," which were exhibited on the weather deck. It may also be stated that uniform of the day had not been changed from "whites" to "blues" at this time. Thus, meteorological conditions and the clothing worn by the crew are regarded as contributory factors. During the month but two cases of acute tonsillitis had been admitted to the sick list, and it was noted that there had been very few complaints of sore throats at routine sick call.

On the morning of the fourth day after leaving Honolulu, however, two men reported with symptoms of acute tonsillitis and were admitted to the sick bay. Examination of these cases, which were typical in all respects, revealed enlarged highly infected tonsils, with caseous material in the crypts, temperature 102° F., pulse 100,

and respiration 20. While smears from the tonsils in each case were negative for the *Corynebacterium diphtheriae* and for Vincent's angina, the patients complained of the fever and of extremely painful sore throats. During the day 35 other men were placed under routine treatment on account of sore throats, but as their symptoms apparently did not warrant admitting them to the sick list, they were permitted to continue on a duty status.

The following morning 6 more cases of acute tonsillitis, similar in type to those already under treatment, were admitted to the sick bay, and during the day 12 additional men reported with mild symptoms. A recommendation to the effect that all men found to be suffering with a mild attack of tonsillitis be isolated in a gun compartment under the supervision of the medical department was approved by the executive officer and immediately placed in effect. All such cases were isolated for a period of three days.

On August 26, 2 patients were admitted and 5 others isolated, while on August 27 the figures were 1 and 4, respectively. During the next three days four new cases were discovered, but it was believed that the symptoms were not sufficiently severe to require their admission to the sick list.

Routine treatment for tonsillitis was given to all patients and symptoms rapidly subsided in all cases. The frequency with which this was given constituted the only difference between those treated in the sick bay and in the gun compartment. In one case a peritonsillar abscess occurred as a complication. It was perhaps a coincidence, but it may be mentioned that two cases of acute appendicitis, which later required operation, developed within four days following the outbreak.

An investigation as to the cause of the rapid spread of the infection among the crew revealed the fact that the use of jugs for drinking purposes was rather widespread throughout the ship. The chief police petty officer was therefore instructed to confiscate and destroy all unauthorized drinking utensils. At the same time a careful check of the work in the scullery showed that sterilization of the mess gear was efficiently performed. Likewise, no interruption was noted in the care of the scuttle butts.

It was concluded from the results of the investigation that the sudden appearance and rapid spread of the outbreak could be explained on the basis of the rather widespread use of jugs for drinking purposes by many of the crew. The white uniform worn at the time and the chilly damp weather during the movies on deck in the evening were probably the exciting causes. Correction of the contributory factors and early recognition, isolation, and treatment of all cases of tonsillitis was followed by prompt subsidence of the outbreak.

Editor's note.—Leaving out of consideration the 85 cases of mild tonsillitis that were treated but not isolated on the first day of the outbreak, there remain 25 cases which were treated and isolated in a gun compartment under supervision of the medical department for a period of three days, a practice entirely contrary to printed instructions.

Attention of medical officers is invited to pages 68 and 69 of the annual report of the Surgeon General, United States Navy, 1928, from which the following extracts have been taken:

Instructions regarding the vital statistics of the Navy require that admissions be recorded in all cases where sufficient disability to require relief from regular duties continues for 24 hours or longer. * * * Admission rates are based on the statistics collected under these instructions. The character of his duties and certain other conditions may determine whether a man with a given degree of disability should be admitted to the sick list. For example, one man with an injury or a cold may receive all necessary treatment and at the same time continue to perform his duties, whereas it might be necessary to take another man similarly affected away from his work altogether. In the first case no admission would be recorded. In general, the statistics account for all cases other than disorders in which symptoms are indefinite and transitory, and injuries of minor importance.

REPORT OF AN OUTBREAK OF MUMPS ON BOARD THE U. S. S. "TENNESSEE"

By E. P. HUFF, Lieutenant Commander, Medical Corps, United States Navy

A sharp outbreak of mumps, comprising 45 known cases, occurred among the crew of the U. S. S. *Tennessee* during the month of January, 1929. At the time of the onset of this epidemic and for many weeks previously the ship had been anchored at or cruising off San Pedro, Calif. Epidemiological reports showed no epidemics of mumps in the near-by cities, but a comparatively small number of cases had been reported.

The high admission rate during the first few days of the epidemic on board indicated that the infections had been contracted from a common source, and the fact that the cases reporting during the first five days after the onset were derived from as many as 10 different divisions indicated that the initial case was among the members of the crew. The daily admissions to the sick list were as follows:

Cases	Cases
January 5..... 1	January 15..... 1
January 7..... 11	January 18..... 2
January 8..... 4	January 24..... 1
January 9..... 12	January 26..... 1
January 10..... 4	January 30..... 1
January 11..... 4	
January 12..... 2	Total 45
January 14..... 1	

While no case of mumps had been encountered, suspicion led to a man who had been admitted to the sick list on December 6, 1928, with a frank case of influenza without complications. This man was discharged to duty after eight days as apparently well and immediately afterward had gone on several days leave in order to visit his family somewhere in the vicinity of San Francisco. He later stated that after his return to the ship he felt very badly, but did not report to the sick bay until December 22, 16 days after his first admission, when he appeared with an acute orchitis, evidently non-venereal in origin and with no history of trauma or other apparent causative agency. He stated that while his "throat had been sore" he had at no time been conscious of any swelling of the jaws, nor, so far as he knew, had he been exposed to mumps while on leave, as he had spent his entire time with his wife and children, who were suffering with influenza, which was epidemic at that time.

Upon reporting at the sick bay this man was isolated and given symptomatic treatment. He was carried on the sick list for eight days and discharged to duty apparently well. The first case of mumps was admitted to the sick list 14 days after this man reported ill.

A significant feature of this case was the fact that this man was a master at arms, and as such his duties required that he cover the entire berthing space of the ship at frequent intervals during the day, when he presumably came in contact more or less intimately with men of all divisions. It is also to be noted that for a week preceding his admission with orchitis he had been feeling very ill and had continued his duties only through fear that he might suffer restriction by being on the sick list.

After the onset of the epidemic an effort was made to check it by making frequent examinations of the men of the divisions from which each patient reported, but it soon became evident that the infection was distributed over the entire ship, whereupon general instructions were issued requiring each man to report to the sick bay as soon as the slightest indications of ill health appeared. As a result of these precautions the admissions had practically stopped within 21 days after the reporting of the first suspected case, the subsequent sporadic cases probably being second-crop infections. The last case appeared about 25 days after the appearance of the first known case.

The disease ran a moderately severe course, and most of the cases were transferred to the hospital ship for convenience of isolation. The records show that nearly all cases suffered bilateral involvement of the parotids, and 13 suffered from orchitis—6 of the left side, 4 of the right, 2 bilateral, and 1 not stated. Two were reported as having an accompanying acute nephritis of mild degree.

Two additional cases, which probably should be included in this group, were admitted during the last few days of the epidemic with orchitis, acute (nonvenereal). These cases were suggestive of the suspected original case, the primary disability having evidently been disregarded by the men until the more disabling complication forced them to seek relief. However, no secondary infections were known to have resulted from these cases.

The time spent on the sick list varied from 19 days in the uncomplicated cases to 26 days in the cases with bilateral testicular involvement. The treatment throughout was symptomatic, with rest in bed and isolation. No surgery was attempted in any case.

The one feature of this epidemic which suggests itself as worth remembering is the fact that any isolated case of orchitis which does not clearly show a causative agent should be considered with grave suspicion and a sharp lookout kept for cases of mumps within the following 10 days or 2 weeks. As in our cases, the early highly infectious stage may be easily overlooked by the patient, and his continued activity about the ship naturally renders him more prone to develop the complication early in the course of the disease.

**AN OUTBREAK OF FOOD POISONING ON BOARD THE U. S. S. "WRIGHT"
DUE TO VIOLATION, THROUGH MISINTERPRETATION, OF EXISTING
INSTRUCTIONS AND ORDERS**

By J. H. HARRIS, Lieutenant Commander, Medical Corps, United States Navy

A severe outbreak of food poisoning occurred on board the U. S. S. *Wright* on the morning of May 16, 1929, while this vessel was moored to Pier No. 2 at the naval operating base, Hampton Roads, Va. On this particular date there were a total of 453 enlisted men attached to the ship, but, deducting from this number 82 who were on leave of absence and 54 who received commuted rations, there were actually 317 on board at the time of the outbreak. Of this number, 98 men were attacked, or about 30 per cent of those exposed. This is considerably greater than the expectancy, which ordinarily varies from 5 to 20 per cent.

Castor oil followed by paregoric was administered to all of those who showed symptoms of poisoning. Of the 98 men affected, 18 recovered within a few hours and 68 within 24 hours, while 11 required treatment for 5 days, and 1 patient, the most severely attacked, remained under treatment for 8 days.

Pork-sausage hash, which, as it happened, was quite appropriately designated on the menu as "surprise sausage," judging from the sensations experienced by those who partook of it, was the suspected article of diet. This hash, which was composed of ground, boiled

link pork sausage, ground boiled Irish potatoes, and seasoning, was baked in the oven on the morning of May 16, 1929, and served to the crew about 7.30 a. m. during breakfast.

The menus for breakfast and for the two preceding days were as follows:

TUESDAY, MAY 14, 1929

BREAKFAST	DINNER	SUPPER
Cereal.	Rice-tomato soup.	Brown beef stew with vegetables.
Milk and sugar.	Hamburger loaf.	Boiled lima beans with cubed bacon.
Scrambled eggs on toast.	Spanish sauce.	Radishes.
Hash brown potatoes.	Mashed potatoes.	Cinnamon buns.
Bread, butter, coffee.	String beans (fresh).	Bread, tea.
	Pineapple-raisin pie.	
	Bread, coffee.	

WEDNESDAY, MAY 15, 1929

BREAKFAST	DINNER	SUPPER
Fresh fruit.	Bean soup.	Fried bologna with tomato sauce.
Baked pork and beans.	Roast leg of veal.	Boiled beans (southern style).
Tomato catsup.	Brown gravy.	Lyonnaise potatoes.
Coffee rings.	Raisin dressing.	Cucumber salad.
Bread, butter, coffee.	Creamed cabbage.	Ginger cake.
	Pumpkin pie.	Bread, tea.
	Bread, coffee.	

THURSDAY, MAY 16, 1929

BREAKFAST
Cereal.
Milk and sugar.
Surprise sausage.
Brown gravy.
Cottage fried potatoes.
Bread, butter, coffee.

From the articles of food listed above, the following were selected as potential causes of the outbreak: (a) Hamburger loaf; (b) brown beef stew; (c) roast leg of veal; (d) fried bologna; (e) and "surprise sausage." Experience has shown that the incubation period, as well as the severity of the attack of food poisoning, depends upon individual susceptibility; the virulence of and the extent to which the food has been contaminated by the causative agent, usually some member of the *Bacillus enteritidis*, paratyphoid group of microorganisms; and the amount of preformed toxin contained in the portion of the food ingested. In view of the fact that the incubation period of food poisoning is short, usually from four to six or eight hours, it was believed that the above foods, with the exception of the pork sausage hash, could be eliminated from the investigation. This belief was further strengthened when inquiry disclosed the fact that those who had eaten breakfast on board but had refrained from eating the suspected food remained well, while each and every one of those who developed symptoms of poisoning had eaten varying amounts of the hash. It was also learned that members of the crew who live ashore in Norfolk or in the immediate

vicinity, many of whom are married, had eaten breakfast at home, as was customary, and remained free of symptoms. None of the suspected food was served in either the wardroom, warrant officers', or chief petty officers' messes, and it is significant that, with one exception, which proved particularly interesting from an epidemiological standpoint, not a single member of either mess was attacked. The assistant to the supply officer, a chief pay clerk, was the exception. He usually arrives aboard ship about 7 a. m. and as a routine procedure always eats some of the crew's breakfast. Following this custom, he sampled the food served in the general mess on the morning of the outbreak, eating about two tablespoonfuls of the hash. About five and one-half hours later he became nauseated. After vomiting freely, all symptoms subsided and he did not report for treatment. It is most interesting to note that he was the only officer on board who ate any of the "surprise sausage" and the only officer who developed symptoms of poisoning.

The first indications of illness appeared exactly two hours after the pork sausage hash was eaten in the general mess, when 5 members of the crew presented themselves at the sick bay for treatment with the physical signs and symptoms indicative of food poisoning. The symptoms consisted of nausea; vomiting; diarrhea; severe cramp-like pains in the abdomen, muscles of the thighs, and legs; occipital headache; chilly sensations; decided pallor of the face; and a moderate degree of prostration. Within a few minutes other members of the crew reported with the same or similar symptoms, and they continued to report in increasing numbers until noon, when 98 men were under treatment.

Of these, 18, who were mildly affected, soon recovered and were returned to duty. The remaining 80, who presented symptoms of greater severity, were transferred to the United States Naval Hospital, Norfolk, Va., for further treatment. As there were only 12 bunks in the sick bay proper and 6 in the isolation ward, 62 patients were cared for on cots obtained from the first lieutenant of this vessel and placed on the port and starboard boat decks until such time as arrangements could be completed for their transfer to the hospital.

All patients were seen by the medical officer within a few minutes after they were attacked. The onset of symptoms was sudden and was accompanied in 15 instances by chilly sensations, although there was no definite chill. Pain, which was described as spasmodic and cramplike, involved the abdomen and muscles of the thighs and legs. A varying amount of abdominal distention was observed in 35 of the 80 cases transferred to hospital. Vomiting occurred early and continued over a period of from one to four hours. The vomitus at first consisted of a large amount of a greenish-yellow semisolid

material, but was followed by smaller quantities of a greenish-yellow liquid. Diarrhea was frequent and profuse, but had ceased by the time the patients reached the hospital. The stools which at the beginning of the attack were very offensive, semisolid, and dark brown in color, became greenish and watery.

Fever of short duration was present in most cases, the temperature varying from 100° F. to 102.6° F., although a subnormal temperature was recorded in several cases shortly after the onset of symptoms. A majority of the patients complained of occipital headache and several stated that this pain was of a severe throbbing type, radiating down into the upper third of the back. Frontal headache was present in a few cases. General aching and muscular soreness was present in all cases transferred to hospital. Practically all of the 98 persons affected experienced some degree of prostration. Among the 18 patients who returned to duty shortly after receiving eliminative treatment, prostration was either mild or absent. Among the 80 more severely affected it ranged from moderate to severe in type, while in 15 of these cases prostration was so marked as to necessitate their transfer to the hospital boat in stretchers. During the period of prostration continuous pallor was observed, but after they had reacted sufficiently, 40 patients showed alternate flushing and pallor. In general, the blood pressure was low. The average of the readings taken at the hospital gave the systolic pressure as 100 mm. of mercury. The diastolic pressure varied from 60 to 70 mm. The blood pressure of three patients, who had a barely perceptible pulse when they reached the hospital, was insufficient to record. In the opinion of the hospital staff, the low blood pressure was due to prostration, dehydration of the tissues, and to toxemia. Dryness of the mouth and intense thirst were prominent symptoms and most patients complained of a continued bitter taste. Ocular symptoms were not noted.

In general, the pulse rate was increased and remained so throughout the day of the attack. In the majority of cases the pulse was regular, but in a few cases it was intermittent. The rate varied from 90 to 130 beats per minute. Respiration, however, was recorded as normal, as was the skin. A total of 15 white blood cell and differential blood counts were made in the laboratory of the hospital. The white blood cell count ranged from 8,400 to 22,000 per cubic millimeter and the polymorphonuclear leukocytes from 75 to 93 per cent. This increase was believed to be due to the acute inflammation and irritation of the gastrointestinal tract combined with a moderate to severe toxemia.

Preparation of suspected food.—The link pork sausage in question was part of a consignment amounting to 50,000 pounds received by the supply depot, naval operating base, Hampton Roads, Va., on

January 21 and 22, 1929, from a local contractor. The sausage had been packed in wooden boxes and was inspected by a representative of the Bureau of Animal Industry, Department of Agriculture, when the car in which it was shipped arrived in Norfolk. All of the boxes were inscribed with the United States Navy stamp, and the contents were found to be in good condition. About 200 pounds of this sausage, well frozen and in boxes, were received on board the *U. S. Wright* on May 13, 1929, and immediately placed in cold storage, which is maintained at a temperature varying from 18° F. to 22° F. One box, containing about 50 pounds, was removed from the cold-storage compartment about noon on the day preceding the outbreak, placed in the galley, and allowed to thaw. About four hours later the sausage in link form was placed in a copper steam kettle and boiled for a period of approximately 30 minutes. The boiling process, a preliminary step in the preparation of the hash, was for the purpose of removing the excess oil and fat and to make the finished product more palatable. After removal from the kettle the sausage was dried and put into a large dishpan, which was then placed on the "dresser" in the galley and left uncovered to cool. About an hour later the dishpan was covered with a clean sugar sack and allowed to remain in the galley overnight. About 4.30 on the morning of the outbreak the sausage was run through a meat grinder and mixed with white potatoes, which had just been previously boiled and ground. As is well known, sausage is ground meat encased in a covering. Boiling caused a number of the coverings to break and the ground meat to adhere more or less in the form of hard masses. It was, therefore, necessary to regrind the meat after it had cooled in order to secure a homogeneous mass. This mixture was placed in large black pans and baked in the oven until brown, which required about 15 minutes. The resulting baked hash, designated on the menu as "surprise sausage," was then served to the crew at breakfast.

About 9.30 a. m., when it became evident that an outbreak of food poisoning was developing, the facts were reported to the executive officer, who was acting as commanding officer in the absence of the captain. Accompanied by the senior medical officer and the supply officer he immediately proceeded to the crew's galley to investigate the cause. At the same time instructions were issued to all division officers by the executive officer directing them to have all men in their respective divisions who appeared to be ill report without delay at the sick bay for treatment. From the character of the articles of food served to the crew for breakfast, the "surprise sausage" was suspected by the senior medical officer as being the offending food. This suspicion was based on the well-known fact, conclusively shown by past experience in the Navy in general, that the foods which

are most often identified with outbreaks of food poisoning are mixtures containing cut or ground meats such as hash; meat or fowl loaf; meat pie; crab, lobster, or chicken salads; hamburger steaks; and cold sliced sausage or meats. A sample of the suspected food was immediately obtained from the galley and sent to the medical laboratory of the United States Naval Operating Base, Hampton Roads, Va., for bacteriological examination, together with a specimen of the urine and feces from a patient under treatment in the sick bay for food poisoning. Due to the unusual demands upon the medical department of the ship, a specimen of vomitus unfortunately was not obtained.

Lieut. C. H. Bitner, Medical Corps, United States Navy, reported that a bacteriological examination of the hash revealed some colonies of *staphylococci* and many of *Escherichia Coli*. The specimen, however, gave negative results when examined for *Clostridium botulinum*, *Salmonella enteritidis*, parathypoid A (*Salmonella paratyphi*), and paratyphoid B (*Salmonella schottmueleri*). The urine and feces were reported as negative. Neither was the hash fed to nor extracts from it injected into laboratory animals.

Pork sausages from the same lot as those which caused the poisoning but from a different box were taken from the cold storage of the U. S. S. *Wright* in a frozen condition on the day following the outbreak, packed in ice, and forwarded by special automobile to the United States Naval Hospital, Norfolk, Va., for bacteriological examination and for feeding experiments on laboratory animals.

The results were reported as follows:

1. Samples of sausage received at 4.30 p. m. May 17, 1929. The samples were wrapped in paper and placed in a bucket with ice. The ice had melted and the package of sausage was covered with water.

2. *Cultures*.—Plated and broth cultures were made. Litmus and Endos plates showed one colony of a nonmotile gram positive spore-bearing bacillus in long chain formation and one colony of *staphylococcus*. Both considered accidental contamination from handling the sausage.

On broth cultures.—*Staphylococcus* and a nonmotile gram positive spore-bearing bacillus and gram negative nonmotile nonspore-bearing bacillus were found. After repeated plating of broth cultures colonies were selected and grown on broth and fermentation reaction determined on the various sugar media, with the result that no pathological organisms could be determined.

3. *Animal experiment*.—A dog was fed with 8 pieces of the sausage and showed no ill effects after 48 hours. A guinea pig was inoculated with 2 c. c. of a killed concentrated culture without showing symptoms other than a mild reaction attributed to injection of a foreign protein.

Samples of urine from each of the 80 patients transferred to the above naval hospital were examined, with the following results: Nineteen cases showed albumin and casts. A culture was made in six cases. All cases were negative on culture, except one which showed *staphylococcus*.

Vomit was not obtainable from any of the patients after they were received at the hospital but bacteriological examinations were made of the feces in five of the more severe cases. "These were negative for the dysentery and typhoid groups. No toxicological examinations were made. The diarrhea had practically ceased when these cases reached the hospital as all had been purged aboard ship."

Summary of investigation.—The above outbreak of food poisoning was undoubtedly caused by pork-sausage hash known as "surprise sausage" and occurred only among those who had eaten this food for breakfast from two to four and one-half hours prior to the onset of symptoms.

Pork sausages, which had been boiled for about 30 minutes, were placed in a dish pan which was allowed to remain in the galley under conditions favorable for the propagation of bacteria during a period of about 11 hours. The coverings of many of the sausages were broken, exposing the contained meat to infection by hands, insects, and rodents. Evidence of deterioration was not observed at the time the hash was prepared or served.

Two men comprising the galley force were not affected with any ascertainable communicable disease. Bacteriological examination of uncooked pork sausage of the same lot, but from a different box, failed to disclose the presence of pathogenic microorganisms, but some *staphylococci* and many *E. coli* were cultured from a sample of the baked hash. While not conclusive, this evidence points strongly to the probability that the sausage was contaminated during the handling, preparation, and cooking on board the U. S. S. *Wright*.

The presence of the colon bacillus in the cooked hash would seem to indicate that the hash was contaminated by human, rodent, or insect carriers such as flies, roaches, rats, or mice, as it is well known that microorganisms of the colon group are not confined to human beings but are found in the intestinal tracts of rats and mice. Food may become infected by hands of carriers soiled with their intestinal discharges unless they take the precaution to wash their hands thoroughly before handling food. However, it can not be stated with positive assurance whether the sausage became contaminated before or subsequent to its receipt on board this vessel. It has been shown that toxins produced through the action of the *S. enteritidis*, paratyphoid group of bacteria, are preserved in frozen meat, although the microorganisms themselves tend to die at very low temperatures. Furthermore, these toxins are not destroyed by the process of cooking.

All personnel having to do with the preparation of food were fully and thoroughly cognizant of all published instructions and estab-

lished orders on this subject. Two important letters regarding the preparation of certain articles of food are as follows:

NAVY DEPARTMENT,
BUREAU OF SUPPLIES AND ACCOUNTS,
Washington, D. C., October 23, 1924.

To: Commanders in chief.

Commandants of navy yards and stations.

Commanding officers of ships.

All officers of the Supply Corps.

Subject: Food poisoning.

1. There have been three or four outbreaks of food poisoning on naval vessels within the past year. These outbreaks have been attributed to meat hash, which was served for breakfast in each instance.

2. From the similarity of the circumstances in each outbreak, it is evident that the meat used in the hash had become contaminated with one of the members of the meat-poisoning group of bacilli.

3. These microorganisms in growing upon meat and certain other foods, at a temperature favorable for growth, such as they find in a warm galley, are capable of producing toxic substances in the course of a few hours which, when ingested, will cause symptoms similar to those recorded in the outbreaks mentioned above. These microorganisms characteristically cause no evidence of spoilage; the contaminated meat is unchanged in appearance, odor, and taste.

4. The most probable methods of contamination are:

(a) Meat infected during life of the animal—a sick animal overlooked during inspection on the hoof.

(b) Meat contaminated by intestinal contents in cutting up the carcass after slaughter. The intestines of healthy animals not infrequently contain bacilli belonging to the meat-poisoning group.

(c) Contamination by rats, mice, or cockroaches which have had access to the feces of rodents in the slaughterhouse or other place in which the meat is stored.

(d) Contamination by the hand of a human carrier. Such contamination may occur at any point from the slaughterhouse to the kitchen but is most likely to occur while the meat is being prepared for cooking or after it has been cooked. The food handler with diarrhea or one without symptoms who harbors bacilli of this group, and who fails to wash his hands carefully after visiting the toilet, is probably the most frequent cause of contamination.

(e) Infestation of the galley with rodents or cockroaches.

5. The bacilli are not heat resistant and are destroyed by a temperature as low as 145° F. in about 15 minutes. The toxic substance produced by the bacilli is resistant to heat, however, and is often capable of withstanding a temperature of 212° F. for 10 minutes. The bacilli tend to die out in the course of time when meat is held in cold storage and particularly when frozen. Unfortunately any toxic substance previously formed is preserved by the low temperature.

6. When meat is ground for hash and incubated over night, assuming contamination has occurred, it is not likely that the heat used in cooking the hash for breakfast will destroy all toxic substance which has been produced, although no living microorganisms may survive the cooking. If the meat has been contaminated by one of the men handling it, growth of the bacilli will obviously occur at warm room temperature no matter how carefully the containers are covered, although covering containers may serve to prevent rodent

or cockroach contamination. Opportunity for contamination by flies must also be considered. The only safe practice to guard against the consequences of contamination which may have taken place on board ship after the meat has been taken from the cold storage room, or from the cans in the case of canned meats, is not to permit a period of incubation to ensue after the moment of possible contamination.

7. Particular care should be exercised by commissary officers to insure that every precaution is taken to prevent contamination of food, particularly meats and meat food products, during the period intervening between their removal from cold storage or containers and their actual consumption. It is believed to be entirely practicable to discontinue the practice of preparing ingredients for hash the night before, or even several hours before the hash is to be cooked and served. If there is not sufficient time before breakfast to perform all of the work necessary in preparing hash, it is suggested that hash be discontinued as an item of breakfast menu.

8. Commissary officers are particularly enjoined to see that all food held in the galley is properly covered to prevent contamination by rats, mice, or roaches, and that every precaution is taken to insure that all foods are handled under the most sanitary conditions. Care shall be taken to see that men who grind or cut up meat are free from manifestations of intestinal disease and that their hands have been thoroughly washed with soap and water before handling the meat.

DAVID POTTER.

DEPARTMENT OF THE NAVY,
OFFICE OF THE SECRETARY,
Washington, March 6, 1925.

To: Commanders in chief.

Commandants of navy yards and stations.

Commanding officers of ships.

Subject: Food poisoning.

Reference: (a) S. and A. circular letter 182-5-J:451 of October 23, 1924 (Bureau Memoranda, p. 8811).

1. There being some misunderstanding of the intent of paragraph 7 of reference (a), it is directed that hereafter no hash be served for breakfast in messes subsisted on the ration in kind unless it is possible to cook and serve the hash immediately after its preparation.

2. Hash shall not be issued at any time when it is necessary to prepare the ingredients the night before, or even several hours before the hash is to be cooked and served.

CURTIS D. WILBUR,
Secretary of the Navy.

Misinterpretation of the above instructions by the chief commissary steward, who believed that they did not apply to meat already ground, led to their disregard and to the storage of partially prepared meat hash in a warm galley for a number of hours before it was to be baked and served to the general mess. Needless to say, the above practice has been discontinued and the meaning of the instructions thoroughly interpreted to those concerned.

Editor's note.—Outbreaks of food poisoning continue to occur at intervals in the Navy and in practically every instance they have been due to causes which might have been prevented had the in-

structions contained in the above two letters been carefully observed. Exposure of meat or meat products, cut or finely divided, to a temperature favorable to the growth of bacteria, such as results from storage overnight in a galley aboard ship or ashore, almost invariably precedes an outbreak. The following paragraphs which are considered pertinent to the subject are quoted from the article, "Food in its Epidemiological Aspects," by Commander J. R. Phelps, Medical Corps, United States Navy, which appeared in the United States NAVAL MEDICAL BULLETIN, July, 1924, Volume XXI, No. 1:

Although meat, fish, or poultry may be contaminated by a food handler who is a carrier, meat poisoning is usually due to contamination before or shortly after slaughter. One piece of meat may be contaminated by coming in contact with another. The toxins are preserved in frozen meat. The bacilli do not multiply at low temperatures and tend to die out in a few days at 10° F., but they may remain viable for several weeks, just as the typhoid bacillus may survive in ice.

With regard to human carriers, Rosenau quotes Bainbridge to the effect that contamination of meat by human carriers of *B. suispestifer* is unknown. That probably includes *B. aertrycke*. Human carriers of *B. enteritidis* are judged to be exceedingly rare. Carriers of *B. paratyphosus B.* are occasionally discovered. Fish and shellfish may, of course, be contaminated in polluted water. Rats and mice may harbor *B. suispestifer* and *B. enteritidis*. Contamination of food with rat or mouse excrement is more likely than contamination by human carriers, and the fly, ant, or cockroach may act as an intermediary carrying agent. Rosenau points out that there is an abundant opportunity for such contamination in the slaughterhouse, in refrigerator plants, in transportation, and in the home.

Flies, cockroaches, and ants must be reckoned with as agents that may carry the bacilli to meat that is kept overnight at warm room temperature in the galley or butcher shop, or to meat that is held over after cooking to be served cold or used for salads, meat pies, hash, etc. It is important to remember that cooked meats and fish require protection as well as uncooked food.

It is important also to note that meat contaminated with microorganisms of this group is unaltered in appearance. These bacilli in their growth do not cause recognizable changes. If there is evidence of spoilage, and as a rule there is not, it is due to the presence of other bacteria.

HEALTH OF THE NAVY

The general admission rate, all causes, based on returns for January, February, and March, 1929, was 402 per 1,000 per annum. The corresponding median rate for the first quarter, 5-year period 1924 to 1928, is 612. The general admission rate was considerably below expectancy, notwithstanding the greater than usual winter prevalence of common infections of the respiratory type and the continuation of the epidemic of influenza in this country.

The admission rate from disease was 370. The 5-year median for the corresponding three months is 544. The admission rate from accidental injuries was 32 as compared with the medial rate, which is 63.

Common infections of the respiratory type were quite prevalent at most training stations. Cases of catarrhal fever were reported as follows: United States naval training station, San Diego, Calif., 146 in January, 232 in February, and 173 in March; United States naval training station, Great Lakes, Ill., 134 in January, 122 in February, and 196 in March; the corresponding figures for the United States naval training station, Newport, R. I., were 227, 52, and 53. With the exception of the month of March, when 65 cases of catarrhal fever, 16 of measles, and 13 of German measles were notified, health conditions at the United States naval training station, Hampton Roads, Va., were exceptionally good. Two cases of cerebrospinal fever developed at the United States naval training station, Newport, R. I., in January, 3 in February, and 4 in March. The United States naval training station, San Diego, Calif., reported 2 cases of cerebrospinal fever in January; also 1 case of scarlet fever in February and 7 cases in March.

The admission rate, all causes, for forces afloat was 352 per 1,000 per annum. This is 35 per cent lower than the median rate for the preceding five years, which is 475.

A total of 573 cases of catarrhal fever were reported by forces afloat in January, 227 in February, and 237 in March.

Acute tonsillitis of scarlet fever occurred on board the U. S. S. *New York* in March in the form of a most unusual and extensive epidemic, which is reported in detail in this issue of the BULLETIN. All of the 189 cases of tonsillitis and 83 cases of scarlet fever comprising the epidemic occurred in March, with the exception of two cases of tonsillitis, which developed in February. The U. S. S. *Lexington* reported one case of scarlet fever and the U. S. S. *Hatfield* one case of diphtheria in January. One case of Black-water fever occurred on board the U. S. S. *Cleveland* in March.

TABLE No. 1.—Summary of morbidity in the United States Navy and Marine Corps for the quarter ended March 31, 1929

	Forces afloat	Forces ashore	Marine Corps	Entire Navy
Average strength.....	75,086	41,050	19,777	116,136
All causes:				
Number of admissions.....	6,609	5,066	1,966	11,675
Annual rate per 1,000.....	352.08	493.64	397.63	402.11
Disease only:				
Number of admissions.....	5,909	4,765	1,844	10,724
Annual rate per 1,000.....	317.98	464.31	372.96	396.76
Communicable diseases, exclusive of venereal diseases:				
Number of admissions.....	2,231	2,859	744	5,000
Annual rate per 1,000.....	118.85	278.59	150.48	175.31
Venereal diseases:				
Number of admissions.....	2,464	640	549	3,104
Annual rate per 1,000.....	131.26	62.36	111.04	106.91
Injuries:				
Number of admissions.....	640	299	121	939
Annual rate per 1,000.....	34.09	29.14	24.47	32.34
Poisonings:				
Number of admissions.....	0	2	1	2
Annual rate per 1,000.....	0	.19	.20	.07

TABLE No. 2.—Deaths reported, entire Navy, during the quarter ended March, 31, 1929

		Navy			Marine Corps		Nurse Corps	Total
		Off- cers	Mid- ship- men	Men	Off- cers	Men		
Average strength.....		8,732	1,727	85,401	1,177	18,604	496	116,136
CAUSE: DISEASES								
Primary	Secondary or contrib- utory							
Abscess, brain.....	None.....			1				1
Abscess, scalp.....	Septicemia.....					1		1
Alcoholism, acute.....	None.....			1				1
Appendicitis, acute.....	Peritonitis, general, acute.....			1				1
Do.....	Peritonitis, local, acute			1				1
Arteriosclerosis, gen- eral.....	Thrombosis, coronary artery.....	1						1
Cerebrospinal fever.....	None.....			3		1		4
Cirrhosis, liver, atrophic.....	do.....	1						1
Cyst, brain.....	Pneumonia, broncho.....			1				1
Dysentery, entamebic.....	Dementia precox.....					1		1
Endocarditis, ulcer- ative, acute (malign- ant).....	Hemorrhage, cerebral.....	1						1
Do.....	Myocarditis, acute.....	1						1
Furunculosis.....	Septicemia.....			1				1
Influenza.....	Abscess, brain.....			1				1
Do.....	Encephalitis, acute, lethargic.....			1				1
Do.....	Pneumonia, broncho.....	1		3				4
Do.....	Pneumonia, broncho, and peritonitis, gen- eral, acute.....			1				1
Do.....	Pneumonia, lobar.....			2				2
Malaria.....	Blackwater fever.....					1		1
Mastoiditis, chronic.....	Thrombosis, left lat- eral sinus.....			1				1
Myocarditis, chronic.....	Arterial hypertension.....				1			1
Do.....	Dilatation, cardiac, acute.....					1		1
Do.....	Endocarditis, chronic.....			1				1
Do.....	Pneumonia, broncho.....	1						1
Do.....	Thrombosis, coronary arteries, right and left.....	1						1
Osteomyelitis, chronic left parital and oc- cipital bones.....	Abscess, brain.....			1				1
Otitis, media.....	Meningitis, cerebral spinal.....			2		1		3
Pericarditis.....	None.....			1				1
Pneumonia, lobar.....	do.....			5				5
Do.....	Meningitis, cerebro- spinal.....			1				1
Do.....	Nephritis, acute.....			1		1		2
Do.....	Pleurisy, suppurative.....			1				1
Syphilis.....	Dementia paralytica.....			1				1
Tuberculosis, chronic pulmonary.....	None.....			2				2
Do.....	Myocarditis, chronic.....			1				1
Do.....	Tuberculosis, mouth and pharynx.....			1				1
Typhoid fever.....	Malaria.....					1		1
Valvular heart disease, combined lesions, aortic and mitral.....	None.....			1				1
Total for diseases.....		7		37	1	8		53

TABLE No. 2.—Deaths reported, entire Navy, during the quarter ended March 31, 1929—Continued

		Navy			Marine Corps		Nurse Corps	Total
		Offi- cers	Mid- ship- men	Men	Offi- cers	Men		
CAUSE: INJURIES AND POISONING								
Primary	Secondary or contrib- utory							
Contusion, cardiac (thrown ball).	None.....			1				1
Drowning.....	do.....	1		15		4		20
Fracture, simple, skull.	do.....			2				2
Do.....	Hemorrhage, trau- matic, intracranial.			2				2
Fracture, simple, skull and neck.	None.....			1				1
Intracranial injury....	Hemorrhage, trau- matic, intracranial.			2				2
Do.....	Pneumonia, broncho			1				1
Injuries, multiple, ex- treme.	None.....			2				2
Landplane crash:								
Burns, multiple.....	do.....	1		1				2
Injuries, multiple extreme.				1		3		4
Wound, gunshot, ab- domen.	None.....					2		2
Wound, gunshot, skull.	do.....					2		2
Wound, penetrating, brain.	do.....			3		1		4
Wound, penetrating, heart.	do.....			1				1
Poisoning, acute, bi- chloride of mercury.	do.....					1		1
Poisoning, acute, strychnine.	do.....			1				1
Total for injuries and poisoning.....		2		33		13		48
Grand total.....		9		70	1	21		101
ANNUAL DEATH RATE PER 1,000								
All causes.....		4.12		3.28	3.40	4.52		3.48
Disease only.....		3.20		1.73	3.40	1.72		1.83
Drowning.....		.46		.70		.86		.68
Injuries.....		.46		.80		1.72		.90
Poisoning.....				.05		.22		.07

STATISTICS RELATIVE TO MENTAL AND PHYSICAL QUALIFICATIONS OF RECRUITS

The following tables were constructed with figures taken from monthly reports submitted by naval training stations:

Cumulative data

	Number	Per cent of recruits received	Per cent of recruits reviewed
<i>Jan. 1 to Dec. 31, 1928</i>			
All naval training stations:			
Recruits received during the period.....	13,589		
Recruits appearing before Board of Medical Survey.....	611	5.50	
Recruits recommended for discharge from the service.....	410	3.02	67.10
<i>January, February, and March, 1929</i>			
United States naval training station, Hampton Roads, Va.:			
Recruits received during the period.....	673		
Recruits appearing before Board of Medical Survey.....	24	3.57	
Recruits recommended for discharge from the service.....	24	3.57	100.00
United States naval training station, Great Lakes, Ill.: ¹			
Recruits received during the period.....	603		
Recruits appearing before Board of Medical Survey.....	35	5.80	
Recruits recommended for discharge from the service.....	18	2.99	51.43
United States naval training station, San Diego, Calif.:			
Recruits received during the period.....	1,241		
Recruits appearing before Board of Medical Survey.....	28	2.26	
Recruits recommended for discharge from the service.....	28	2.26	100.00
United States naval training station, Newport, R. I.:			
Recruits received during the period.....	688		
Recruits appearing before Board of Medical Survey.....	47	6.83	
Recruits recommended for discharge from the service.....	14	2.03	29.79

¹ February report not received.

The following cases, selected from reports of medical survey recently received by the bureau, are presented to indicate conditions existing prior to enlistment which led to early separation from the service. These conditions were so evident that the men should have been rejected at their respective recruiting stations.

The men in the following cases were all apprentice seamen with less than one month's service. Physical defects responsible for their discharge from the Navy were discovered when they were reexamined at a naval training station within a few days after they were enlisted.

Visual defects.—Enlisted at Newark, N. J., May 7, 1929. Vision, right eye, 20/20; left, eye 4/20. He had no knowledge of this defect prior to examination, but gave a history of occasional headaches. Surveyed May 13, 1929.

Enlisted at Boston, Mass., March 9, 1929. Vision, both eyes, 8/20. He failed to pass the eye test at the recruiting station in November, 1928, but succeeded four months later, after he had memorized the vision-test charts. Surveyed March 18, 1929.

Color blindness.—Two cases. One man enlisted at Dallas, Tex., March 6, 1929, and the other at Salt Lake City, Utah, May 1, 1929. Both were unable to successfully pass the Stillings, Jennings, Eld-

ridge green lamp, or the skein tests for color perception. Both stated that they were not given the Stillings or Jeanning's tests at the time of enlistment. The former was surveyed March 14, 1929, and the latter May 10, 1929.

Otitis media, chronic.—Enlisted at Indianapolis, Ind., March 9, 1929. He gave a history of a chronic discharge from his left ear during the past five years and stated that he had been under the care of a specialist for two weeks in the summer of 1928. Examination revealed a large perforation in the drum of this ear. Surveyed March 12, 1929.

Dental defects.—Enlisted at Buffalo, N. Y., March 7, 1929. This man had only 15 sound teeth. Of the remainder, Nos. 8, 16, 19, and 30 were missing, No. 17 impacted, and Nos. 7, 8, 9, 10, 11, 12, 13, 14, 15, 18, 21, and 31 were carious. Exodontia was indicated in connection with No. 12 and probably pulp involvement in several others. The teeth were generally unsound, and there was a lack of the requisite number of sound opposing molars. Surveyed March 12, 1929.

Deformity.—Enlisted at Newark, N. J., March 7, 1929. In this case there was a moderate degree of scoliosis, the right shoulder was about $3\frac{1}{2}$ inches lower than the left, and numerous dilated blood vessels were seen over the scapulæ. The condition was of about two years' duration, and no history of injury was obtained. The patient complained of precordial pain after slight exercise and had a tachycardia, which persisted after rest. The pulse rate was 120 per minute, but no heart murmurs or enlargement were found. Surveyed March 12, 1929.

Defective physical development.—Enlisted at Louisville, Ky., March 5, 1929. Examination disclosed a tall, poorly developed man. There was a definite scoliosis, with convexity to the left, associated with tilting of the pelvis. The right anterior superior iliac spine was about 1 inch lower than the left. He had flat feet, malocclusion of the teeth, and he was, in general, a poor physical specimen. Surveyed March 8, 1929.

Hernia.—Enlisted at the recruiting station, San Francisco, Calif., April 12, 1929. He had a well-defined right inguinal hernia, which had been recognized one year previously. Operation refused. Surveyed April 10, 1929.

Enlisted at the recruiting station, San Francisco, Calif., April 6, 1929. He had an incomplete right inguinal hernia, which he first noticed after playing a game of football one year before. Because of the attendant pain at this time he consulted a physician who advised rest for several days. He refused operation. Surveyed April 17, 1929.

Organic heart disease.—Enlisted at Providence, R. I., February 1, 1929. Admitted to hospital six days later on account of dyspnoea, palpitation of the heart, and precordial pain on the slightest exertion. The patient stated that the condition had existed for the past three years and that he had attempted to enlist at four different times, but had been rejected because of "heart disease." Examination revealed enlarged heart, more pronounced left side, which was confirmed by X-ray findings, presystolic at apex transmitted to the left, marked thrill, and characteristic pulse. Surveyed March 1, 1929.

Chronic pulmonary tuberculosis.—Enlisted at Des Moines, Iowa, March 4, 1929. Signs and symptoms of an active pulmonary tuberculosis involving both upper lobes were found at a training station and confirmed at a naval hospital. An X-ray examination showed the presence of an active, moderately advanced, fibro caseous tuberculosis involving both upper lobes, especially the left, with cavitation in both apices. The diaphragm was slightly irregular as a result of basal adhesions. Repeated sputum examinations were positive for tubercle bacilli. Surveyed March 29, 1929.

Chronic nephritis.—Enlisted at San Francisco, Calif., February 1, 1929. This recruit stated that he had suffered from nephritis for the past six years and that during acute attacks he had puffiness under the eyes, severe headaches, digestive disturbances, vertigo, and defective vision. Urinalysis performed at a training station disclosed a large quantity of albumin, together with many hyaline and granular casts. The patient stated that his urine was not examined at the recruiting station. Surveyed February 14, 1929.

The following apprentice seamen were in the Navy a little more than one month:

Flat foot.—Enlisted Salt Lake City, Utah, February 4, 1929. Examination at a training station showed a high degree of flat feet with decided eversion. "Patient walks entirely on inner margin of feet. This is a typical case with exaggerated physical findings." Surveyed May 10, 1929.

Renal calculus.—Enlisted Houston, Tex., March 8, 1929. History of frequent urination and vesicle tenesmus for several months prior to enlistment. A large amount of albumin, many pus and red blood cells were found in his urine. X-ray examination showed evidence of tuberculosis and an opaque mass in the pelvis, of the left kidney. The patient admitted that he was only 16 years of age and stated that his urine was not examined at the recruiting station. Surveyed April 10, 1929.

Faulty union of fracture.—Enlisted at Philadelphia, Pa., January 7, 1929. History of injury to left elbow 12 years prior to enlistment. Has not had full use of his arm since. Examination revealed deform-

ity left arm, loss of carrying angle, about 2 cm. shortening, and atrophy of the entire limb from disuse. In flexion he lacked about 30° of full function and in extension motion was limited to 45°. X-ray examination showed an old fracture of the external condyle, with nonunion and malposition. A fall from his hammock at a naval training station two weeks after enlistment probably aggravated the condition. Surveyed April 16, 1929.

ADMISSIONS FOR INJURIES AND POISONING, FIRST QUARTER, 1929

The following table, indicating the frequency of occurrence of accidental injuries and poisonings in the Navy during the first quarter, 1929, is based upon all Form F cards covering admissions in those months which have reached the bureau:

	Admissions January, February, and March, 1929	Admission rate per 100,000 per annum	Admission rate per 100,000, year 1928
INJURIES			
Connected with work or drill.....	550	1,894	2,852
Occurring within command but not associated with work.....	282	971	1,855
Incurred on leave or liberty or while absent without leave.....	107	369	1,139
All injuries.....	939	3,234	5,846
POISONING			
Industrial poisoning.....	0	0	27
Occurring within command but not connected with work.....	1	3	125
Associated with leave, liberty, or absence without leave.....	1	3	42
Poisoning, all forms.....	2	7	194
Total injuries and poisoning.....	941	3,241	6,040

Percentage relationships

	Occurring within command—				Occurring outside command— Leave, liberty, or A. W. O. L.	
	Connected with the performance of work, drill, etc.		Not connected with work or prescribed duty			
	January, February, and March, 1929	Year, 1928	January, February, and March, 1929	Year, 1928	January, February, and March, 1929	Year, 1928
Per cent of all injuries.....	58.6	48.8	30.0	31.7	11.4	19.5
Per cent of poisonings.....	0	13.8	50.0	64.4	50.0	21.8
Per cent of total admissions, injury and poisoning titles.....	58.4	47.7	30.1	32.8	11.5	19.5

Poisoning by a narcotic drug or by ethyl alcohol is recorded under the title "Drug addiction" or "Alcoholism," as the case may be. Such cases are not included in the above figures.

The following cases, selected from January, February, and March, 1929, reports, are worthy of notice from the standpoint of accident prevention:

Gasoline Hazards.—A back-fire ignited exposed gasoline when a seaman, second class, attempted to start the engine of a motor whaleboat. Results, burns of the left hand and forearm. Loss of time, 5 days.

Gasoline in the bilges of a motor whaleboat from a flooded carburetor became ignited by the back-fire of the engine. A fireman, second class, received burns of his face and forearms. Loss of time, 3 days.

A fireman, second class, engineer of a motor launch, received burns of the face and right forearm when a back-fire of the engine ignited exposed gasoline. Loss of time, 6 days.

Gasoline fumes on board a motor whaleboat became ignited by the back-fire of the engine, which was started after the gasoline tank had been filled. A fireman, first class, received first degree burns involving his face, hands, and legs in the resulting explosion. Loss of time, 9 days.

Neglect of Safety Device.—An apprentice seaman engaged in cleaning windows failed to secure himself before stepping on a window ledge in the second story of a building. He lost his balance and fell upon the concrete walk below. A fracture of the right os calcis resulted. Loss of time was 77 days, and the patient was still under treatment at the end of the year.

An engineman, second class, received burns of his left hand when he attempted to extinguish a fire on board a motor tug caused by gasoline which had become ignited. Loss of time, 5 days.

Firearms, Careless Handling of.—A private marine received a punctured wound of a leg when a revolver which he was unloading in order to clean was accidentally discharged. Loss of time, 17 days.

Due to his own negligence in carelessly handling a loaded rifle, a private marine received a punctured wound of the left foot when the weapon was accidentally discharged. Loss of time, 66 days.

Knife, Careless Handling of.—A seaman, second class, while slicing cheese, placed his right index finger beneath the cutting edge of a heavy knife. He received an incised wound of the finger. Loss of time, 20 days.

Hatchway Hazards.—A seaman, first class, sustained a contusion of the back when he fell through an open hatch at night. The hatch was neither guarded nor lighted. Loss of time, 9 days.

Manhole Hazards.—Through the "lack of a safety device," where one could have been used, an engineman, second class, fell through

an open manhole on board a barge. He received a lacerated wound of a leg. Loss of time, 46 days.

Turret Hazards, not Drill.—A seaman, second class, who through his own negligence was lying across a gunport of a turret, received a contusion of the right hip when the gun was lowered. Loss of time, 19 days.

Lack of Safety Device.—A carpenter's mate, first class, who was operating a wood joiner, caught his left hand in the machine and received lacerated wounds of the second and third fingers. No safety device was provided where such could have been used. Loss of time, 14 days.

Unsafe Practice.—Lack of eye protection.—While a torpedoman, first class, was operating a "sanding machine" the cover was blown off, throwing sand into his eyes. He neglected to wear protective goggles. Loss of time, 5 days.

A flying piece of steel lodged in the unprotected left eye of an apprentice seaman who was operating a shaper in a machine shop. There was no loss of time in this case.

Unsafe Practice—Applying "wing dope" in a confined space.—Due to improper and insufficient ventilation, a painter, third class, was overcome by the fumes while working with "wing dope" in a confined space aboard ship. It is stated that work of this character can not be successfully accomplished on the open deck. Loss of time, 58 days.

Unsafe Practice—Lye solution.—An engineman, second class, was boiling a paint can in a solution of lye. Splashing of the solution caused a chemical burn of an eye. Loss of time, 3 days.

Stepping on Objects.—Razor blade.—A seaman, second class, received a wound of a foot when he accidentally stepped on the blade of a safety razor carelessly dropped by another on the deck of a shower bath. Loss of time, 17 days.

Exposure to the Sun's Rays.—Sunburn resulting from insufficient clothing worn while exposed to the sun's rays caused the admission to the sick list of 3 men on board battleships and 16 on board smaller craft. In 11 of the 19 cases the men were working when the injury occurred. Total loss of time, 75 days.

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